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THE BEST SURGICAL DRESSING
AND
BEACH'S PRINCIPLE
OF
BULLET-WOUND TREATMENT.

~~1888~~

THE BEST SURGICAL DRESSING

How to Prepare it and How to Use it

WITH A CONSIDERATION OF

BEACH'S PRINCIPLE OF BULLET-WOUND TREATMENT

BY

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BEST
SURGICAL DRESSING.

BEST

SURGICAL DRESSING.

A somewhat extended and interested observation of the subject, among cases in private practice and at public clinics, has convinced me that but few of us have found time to become familiar with the true chemistry, physiological action, and best surgical use of iodoform. Four years ago I had daily opportunities to see results of the clinical tests which its use as a surgical dressing furnished at the clinic of Professor Billroth, and with much enthusiasm I translated shortly after the admirable book by Dr. Mikulicz, so much quoted and criticised since its publication, on

“Die Verwendung des Iodoforms in der Chirurgie.”

In that part of the book treating of gunshot wounds I was greatly pleased to find that the method advocated by Mikulicz was exactly that pursued by Dr. H. H. A. Beach, in his clinic at the Massachusetts General Hospital, at the time I had the privilege of acting as surgical house-officer there, and, moreover, that some of Dr. Beach's cases antedated those of Mikulicz and other surgeons quoted by him. At that time, however, the value of iodoform was in need of further confirmation, except at the clinics of Billroth, Mosetig-Moorhof and some few other operators, and the discussion of bullet wound treatment, through the Garfield case and other sources, had become somewhat tedious and unprofitable. It was, therefore, decided to withhold the publication of the present book for further developments.

I am now happy to say that the great value of iodoform, *when properly used*, has been proved beyond a doubt, and it is pleasing to quote from Professor Wölfler's address on the "Progress of Surgery in the Last Decennium," delivered before the Society of Physicians at Graz, on the 26th of November, 1887, the following in regard to iodoform: "Iodoform does not really fulfil all the requirements of an anti-septic as we have named them, it is not soluble in water and is also not cheap." "That it has in spite of this held its place speaks all the more for its worth." "Unlike any other agent it is able to develop a *continuous action*" (Dauerwirkung). "That it produces intoxication when used in large amounts there is no doubt, but only in quantities which for wound treatment are entirely superfluous." "It acts as a sort of wound-police (Wundpolizei) remaining quiet as long as the wound is aseptic, and first developing its action when decomposi-

tion appears." "It is thus explained why some bacteriologists designated iodoform as an entirely inactive agent, while practical surgeons were praising it to the skies." "A strip of iodoform gauze, a wood-wool sack, and a bandage over this, is all that I use for any wound at my clinic." "How far iodol is able to replace iodoform is as yet insufficiently determined."

When used to the best advantage, in the plain or adhesive gauze as made by Prof. Mikulicz, there *is no trouble from its odor*. A square yard of the gauze is sufficient for from twenty to fifty dressings.

It is well to remember that the practised surgeon of to-day seldom needs any dressing as far as the result in fresh wounds of operation is concerned, since there he almost invariably has a wound which goes on to complete union without any suppurative action. When, however, the wound comes to him in a septic condition, or through some unavoidable accident

becomes in its later progress a septic one, then the great desideratum is that form of dressing which will, since its insoluble basis is not rapidly diluted and washed away by the discharge, remain as a permanent protection to the surface exposed. For this purpose nothing thus far discovered, can stand comparison with iodoform.

With the hope that I may substantiate this fact, for all to whom it will be of interest and value, I am sure that I can do nothing better in addition than to give my translation of Mikulicz's book. I must apologize for the little revision that I have found time to give it, but with the exception that the iodoform is now used mostly in gauze and but little in bulk, and that the tests then made of its antiseptic action would not be satisfactory to the bacteriologist of to-day, I believe it contains much that will be valuable and interesting to every practitioner.

THE USE OF IODOFORM
IN
SURGERY
BY
DR. JOHANN MIKULICZ.

Translated from *Wiener Klinik*, 1 Heft,
January, 1882.

PART I.

ON THE GENERAL APPLICATION OF IODOFORM IN SURGERY.

When about sixteen years ago the Listerian method of wound treatment began to be generally known, every surgeon who applied it thoroughly, was soon convinced that its results were decidedly uncommon. Compared with the former progress in wound treatment the advance was so great, that it is easily understood why there were many at that time who were convinced that the Listerian method accomplished all that lay within the compass of human reason, and

that further progress would be impossible. Science, however, knows no stand-still, and as the healing art rests upon a scientific basis, it must progress as long as it receives the attention of thinking men. Those who regarded Lister's great discovery as the creation of a higher genius did not venture to interfere with his method, and in part still adhere to its every detail.

In their eyes it was an unwarranted risk to attempt changes or improvements. Those on the other hand who saw in it only the careful work and study of years, were convinced from the first, not that they honored the great master any the less, that the method like every other human production could be improved and simplified and in time, perhaps, replaced by something better.

Thus it happened that a great variety of changes were soon tried. Many of these proved useless, but in time modifications were found and introduced, which led to

simplification and improvement. First of all the silk protective was found to be unnecessary. Then instead of the costly Mackintosh, cheaper waterproof materials were taken, which served the same purpose. Furthermore, we learned by Bruns' method to prepare the carbolic gauze in a more simple and convenient manner. Doubt was also raised in regard to the indispensability of catgut, and to-day we know that antiseptic silk prepared according to Czerny accomplishes in most cases the same ends, and in some is even to be preferred.

Eight years ago many eminent surgeons began a war against the spray, which until that time had been regarded as one of the most important facts of the antiseptic method. A. Bidder, Trendelenburg and Von Bruns announced that they had for a number of years operated without spray, and obtained results equal to if not better than those of surgeons using it. I, also,

warranted both by theoretical and experimental study, endeavored at that time to demonstrate that the spray might be left out of the antiseptic method without injury, and I see my conclusions verified to-day by an almost two years' trial on Prof. Billroth's clinic, where since March, 1880, the spray has neither been used at operation nor dressing. Besides this, constant efforts were being made to substitute for carbolic acid, to which Lister assigned the first place, some other antiseptic. Nearly all the antiseptics underwent trial with more or less success, but still carbolic acid, notwithstanding many evil qualities, held its place until recently. To thymol and benzoic acid only a very restricted application is to-day conceded. The chloride of zinc dressings recommended by Badeleben have as yet made no place for themselves. Latterly other antiseptics have been tried with very fair results, but they too have failed to find

general approval. I will only mention the acetate of aluminum dressing recommended by Burow, and later by Mass, and the weak chloride of zinc solution which Tucker warmly recommends.

All these efforts are to-day forced into the back-ground through Von Mosetig-Moorhof's introduction of iodoform in surgery. We have found in iodoform an antiseptic which, although it does not put carbolic acid entirely aside, is superior to it in many respects, and has therefore won a place in surgery which it will retain until some better medium is discovered. Iodoform especially replaces carbolic acid where the latter was used for dressing purposes, and is to-day *the* antiseptic for wound dressings. Then the carbolized gauze dressing is replaced by a better — the iodoform gauze; and of the entire Lister dressing nothing remains to-day but the principle, and that stands as unassailable as ten years ago.

But I have anticipated. I will give

you in the following a summary of the experience thus far had with iodoform. This consists mostly of observations which I have made on the clinic, and under the guidance of my highly honored instructor, Professor Billroth. Further experience I owe to my department in the polyclinic and to my private practice.

The iodoform treatment was introduced into Billroth's clinic in the beginning of last year, and I had during that time numerous opportunities of making communications in regard to it. Once, at the first sitting of last year's surgical congress at Berlin, later in a paper read before the Vienna Medical Society, and finally in an article published in the Berlin *Klinische Wochenschrift*. That I now feel myself once more called upon to speak upon the same subject, and more fully, is due to the importance which iodoform has recently won in surgery. From the general interest which iodoform awakens not only in practical

surgeons, but as it should, in physicians also, a connected account of all that is known in regard to its application should not be without value to you. This splendid remedy can be applied in so simple a manner and with such satisfactory results in every day practice, that I consider it my duty to extend its use wherever possible.

The history of iodoform is brief. It was although early known to chemistry, first introduced into the healing art some twenty years ago, when in 1862, Rhigini published the first pharmacological work in regard to it. It was first used by Nunn, Besmier, Fěřěol, Bozzi Zeissl and others, and with advantage in the treatment of different syphilitic sores, and in this direction is probably known to most of you as an excellent remedy. Later, Greenhalgh, Demarquay, Völker and then Hisch and others used it for different gynæcological purposes and it was also given internally. Still reports in regard to it did not agree. In later years,

Moleschott, (*Wiener Medicinische Wochenschrift*, 1878, No. 24 and following,) after seeing many brilliant results again drew the profession's attention to it. Nevertheless, the remedy remained but little noticed, particularly by surgeons until Von Mosetig, by an article also appearing in the *Wiener Medicinische Wochenschrift*, placed it definitely in surgical treatment. Von Mosetig at first used iodoform only for those wounds which had taken on fungous development, and recommended it merely as a remedy, which as well as an antiseptic, exerted in addition an anti-tuberculous action.

After these announcements Prof. Billroth in Jan., 1881, introduced iodoform into the clinic, at first only for Von Mosetig's purpose, that is the treatment of tuberculous wounds.

We very soon found, however, that apart from this specific action, iodoform was an excellent antiseptic, and tried it for wounds

of a different nature as well. Here too, it was of great service, so that we learned from time to time to apply it in ever-increasing directions. Since April of the preceding year all wounds, and particularly those from operation, are treated with iodoform. Von Mosetig later announced that he had before not only used it in the treatment of fungous joint and bone disease, but also with good results in the treatment of fresh wounds.

Von Mosetig's early announcements drew forth much doubt and received at first but little attention. I was, therefore, on the ground of the experience at Billroth's clinic, the first to confirm them. At the time of my first communication in regard to it, at Berlin, Gussenbauer was the only one who had also applied iodoform and he agreed entirely with me. From that time the remedy rapidly gained ground and scarcely ever has an improvement in the healing art found such rapid and universal acceptance. Already numerous announcements from

other prominent clinics have appeared, essentially confirming those of the Vienna clinic. I will mention besides Gussenbauer's, those of Von König, Henry, Merkel, Leisrink, Falkson, and Höfftman. To some of these we will incidentally refer; at present let it suffice to say that aside from slight differences in regard to its mode of action, all of the authors give to iodoform the highest importance.

Iodoform is a substance analogous in composition to chloroform, and contains according to the chemical formula about 96 per cent of pure iodine. It is readily soluble in ether, fats and fluid oils, with more difficulty in alcohol, and only to a slight extent in water and saline solutions. After long standing iodine separates in substance from the ethereal and fatty solution. The physiological action of iodoform has thus far been investigated only by Moleschott, Högyes and Binz. They have found that by whatever method applied, it is taken into the

economy. Whether through the skin, a serous membrane or the subcutaneous cellular tissue, salts of iodine are always to be found in the urine. These investigators agree that the iodoform becomes dissolved by the fatty substances of the body, that free iodine is gradually separated from this solution, and that this again becomes changed into iodine salts. The action of iodoform is then, according to this view, nothing but a protracted iodine action; being distinguished however, by the fact that the iodoform exerts no irritant action on the tissues and still acts very powerfully. I must here remark that iodoform gets into the system not only in the form of simple iodine salt but also as an organic combination and perhaps as pure iodoform. At least Professor Ludwig found in a case, to be mentioned later, which terminated fatally from iodoform poisoning, an unstable iodine combination in the internal organs.

Binz and Högyes have further found that

cats and dogs after administration of larger quantities of iodoform, die from paralysis of heart and respiratory functions, and fatty degeneration is found in their internal organs.

Oberländer reports two cases of poisoning in man. Both suffered from weakness, sleepiness, vomiting, irregular breathing and other uncomfortable symptoms, but recovered finally. I will later speak of two cases of iodoform poisoning observed on Billroth's clinic.

Of the local and general action of iodoform, I can say the following, taken from my own observation and experience as well as that of others.

Locally, iodoform is absolutely unirritating. Under the iodoform dressing, wounds show still less reaction, if possible, than under the carbolic. On this account granulation appears to go on more slowly than with other dressings.

From the time the wound is covered

with iodoform it remains perfectly painless. I do not mean to infer that this is due to a specific anodyne action, as no antiseptic wound should be painful during the healing process. Iodine combinations are very soon taken up from the wound and appear to be transferred continually and as long as iodoform remains in contact with the wound. We have often been able, even after a few hours, to detect salts of iodine in the urine and saliva, and from that time to obtain daily during weeks a plain iodine reaction in these secretions.

Appearances of a general action on the organism are completely absent during the application of small amounts. After applying large quantities to extensive absorption surfaces, light symptoms of intoxication appear, such as weakness, nausea, loss of appetite, and, although rarely, vomiting. These however, subside after from twenty-four to forty-eight hours, and give place to complete eupathy.

Although, as far as I am aware, dangerous symptoms of poisoning from the iodoform dressing have not been observed as yet, I am familiar with two cases from Billroth's clinic which showed, after application of large quantities of iodoform, symptoms which were undoubtedly those of chronic iodoform poisoning. Both cases were weak, reduced children, operated upon for suppuration of carious hip-joints. In one case Prof. Billroth opened a large abscess connected with the joint, in the other I made the typical joint resection. The wound cavities were filled with iodoform (forty to one hundred and twenty gm.) The wounds healed splendidly, and the children were, during the first three weeks, in good condition, had appetite and slept well. In the beginning of the fourth week, however, slight signs of meningitis appeared, apathy, restlessness, staring glance, wide pupils, crying aloud, retraction of the abdomen, somnolence and light

clonic cramps. Still there was no significant rise of temperature; the pulse was one hundred and ten to one hundred and twenty, the muscles of the neck not contracted, and no loss of muscular power was demonstrable. At the end of the fourth week both children died, and the post-mortem examinations gave negative results. In the second case, as already mentioned, Prof. Ludwig found an unstable iodine combination in all the internal organs. In the first case no chemical examination was made. We were convinced that both cases were chronic iodoform poisoning, and to-day we are confirmed in our opinion, as cases with similar symptoms have occurred elsewhere. Henry reports two cases from the clinic at Breslau, and König a case from his clinic. Henry's two cases were, which is of special interest, adults, while König lost a child after a similar hip resection. Latterly other cases of iodoform poisoning

have been reported, in some of which quite long lasting delirium appeared.

Since these experiences we have abandoned the use of such large quantities as Von Mosetig formerly applied, and particularly since finding that the same results are attainable with much smaller amounts, which from an economical standpoint as well, is not to be disregarded. With weak children it is particularly advisable not to apply iodoform in large quantity. It suffices to simply cover the wounds with a thin layer of iodoform or to cover or fill them with iodoform gauze alone. Although this here and there necessitates a somewhat more frequent change of dressing it reduces the danger of iodoform poisoning to a minimum. At least I have latterly seen no signs of a suspicious nature. The dressing technique I will later speak of in full.

It is very important for us to know more exactly the antiseptic properties of iodo-

form, and as no researches have as yet appeared in regard to it, I have made in conjunction with Dr. Paneth, a series of striking experiments.

Allow me to make you familiar with the results of these experiments, as I consider it important for us to be familiar with the antiseptic action of a remedy before applying it extensively. We ought to know exactly how far we can rely upon the antiseptic action of iodoform; how far it is capable of replacing the antiseptics formerly used — carbolic acid, etc., in order that we may assign to this excellent medium its proper work, and not let ourselves be led, through enthusiasm from otherwise brilliant results, into requiring more of iodoform than it is capable of performing. My experiments were proceeded with as follows: I took a series of fluids, which according to universal experience, form a favorite fostering soil for the development of germs. These fluids were, Pasteur's

solution, one per cent. meat extract solution, one per cent. malt solution, one per cent. peptone solution, alkaline urine, beef water, and diluted blood, (fresh ox blood diluted with an equal quantity of water). A large number of nutrient fluids was intentionally chosen because similar researches by other investigators have shown that different nutrient solutions bear different relations, not only to the germs, but to the various antiseptics, so that a very one-sided result is obtained if only one solution be used. As iodoform is only slightly soluble in the decomposable fluids, we had more difficulties to encounter than the investigators who tested easily soluble antiseptics. I first saturated the above solutions by pouring them several times through a muslin filter covered with iodoform crystals. I could assume that in this way each of the fluids had taken up as much iodoform as possible without carrying away any of it in substance.

Each of the fluids was now put in a glass vessel, and placed in the breeding-oven. At the same time a corresponding number of glasses containing uniodoformized solutions — controlling solutions — were exposed to the warmth of the oven. The result was as follows: In some of the fluids, those apparently which had taken up a very small quantity of iodoform, the antiseptic action was nearly null. In others on the contrary, the beef water, and blood, namely, which contained more iodoform proportionately, a delay in the development of germs and foulness was plainly proved. It is here worthy of notice that the characteristic iodoform odor, which was at first given out from all the fluids, disappeared from those first mentioned after a few hours — (iodoform is, as you know, a volatile substance), while in the last named it was demonstrable after twenty-four hours.

From this series of experiments it fol-

lows that the iodoform taken up by the fluids in filtering was capable of exciting very little antiseptic action. This probably being due to the rapid evaporation and decomposition of the small amount dissolved.

In a second and third series of experiments, I mixed directly with the nutrient solutions a large quantity of iodoform. The fluids were well stirred every twelve and twenty-four hours, and in this way an excess of iodoform constantly maintained. The result was now essentially different. In most of the fluids the development of germs was completely arrested, in others it appeared only late and sparsely. It is important to mention that in all the fluids, even where slight germ development occurred, signs of actual decomposition failed completely. The beef water and blood for instance, remained constantly odorless, that is, they smelled only of iodoform. As is well known, the absence of signs of decom-

position with slight development of germs is an occurrence often met with in the healing of wounds. Germs are even found in faultless cases under the Lister dressing. They are harmless forms which would only be of importance where they might conjointly give rise to decomposition. We can therefore say that where iodoform is mixed in larger quantities with a decomposable fluid, it exerts a weak but constant antiseptic action. Its action is such that wherever iodoform is in excess, signs of decomposition are sure to remain absent.

This action which answers for many purposes of wound treatment completely, is nevertheless for others wholly insufficient.

From my experiments as well as my clinical experience, I can say that wherever it remains for a long time in contact with a wound, iodoform acts surely and powerfully, and in this direction deserves preference to all other antiseptics. As it does not irritate the tissues, it is adapted to every

form of wound. On the other hand iodoform lacks rapid, energetic, disinfecting properties, so that in this direction it can never displace other powerful antiseptics. For many measures of antiseptic wound treatment, particularly disinfection of the hands, the operating field instruments and sponges, iodoform is not suited. We cannot therefore, as yet, dispense with carbolic acid in the antiseptic wound treatment, and it would be a mistake to think of applying iodoform alone as an antiseptic.

Antiseptic precautions before and after operation are to be carried out with the same care as formerly. Washing, brushing and disinfection of the operator's hands, as well as the operating field should be done with the utmost exactness. The instruments and sponges, and the silk and drainage tubes should be disinfected with strong carbolic solution three per cent., and I would not, as yet, discontinue irrigation of the wound with five per cent. carbolic solution. The

iodoform first reaches its application after the operation.

We will now consider the manner in which iodoform is applied to wounds, and I will first speak of its application in general, and then pass to its particular application to wounds. Iodoform comes in the market in fine crystals, and can be used in that form. As a rule, however, it is much more efficient used as a powder, as in this form it comes in more intimate contact with the wound. Besides this, less of the powdered iodoform is needed and it is thus economical.

The crystalline form is preferable only where it is desirable to directly cover a large wound and intoxication is feared; Güterbock properly calls attention to the fact that the finely powdered iodoform, by its ready solubility and more intimate contact with the tissues, becomes much more rapidly and abundantly absorbed, and therefore gives rise to poisoning more readily than the crystalline.

As is well known, iodoform has a very penetrating odor, which to many is quite unbearable. Although the physician soon accustoms himself to it, it is none the less necessary to have regard for the patient, and cover or modify it with a correctant. According to my experience, oil of bergamot is a good deodorant, one drop of which, if thoroughly rubbed with ten gms. of iodoform will cover the odor decidedly. Von Mosetig recommends the Tonca bean for this purpose. Two beans split in halves if put in an air-tight vessel with about one hundred gms. of iodoform will cover its odor in a few days with the peculiar Tonca bean odor. If it is to be applied in large quantities, iodoform can be handled directly with a spoon or spatula. If only as a thin layer, which suffices for many purposes, an ordinary pepper box arrangement is useful. The perforations should be made somewhat larger than usual,

as the iodoform, particularly that treated with oil of bergamot, easily stops up small ones. Should the object be to dust the wound with a very thin layer, it is best to use the iodoform duster, invented by my friend, Dr. Wölfler, and manufactured by Leiter, in Vienna. The same end is often accomplished by firmly wiping out the wound with iodoform gauze or cotton dipped in iodoform. In this way a quantity sufficient for many purposes adheres to the wound.

If a completely open wound is in this way sufficiently covered with iodoform, the further dressing is as a rule very simple. An adequate amount of absorbent cotton and a piece of waterproof material are fastened over it with a bandage. It does not matter what sort of waterproof material is used. You can use rubber sheeting, oiled-silk, waxed-cloth or parchment paper, and even the cheap wax and varnish papers are sufficient.

Instead of cotton, ordinary jute may be used. In fact, it makes no great difference what is used for absorbent after the wound has been covered with iodoform. This sort of dressing, however, is only suited to open wounds which can be directly dusted with iodoform, and is not adapted to wounds for union by first intention. If the wound is to unite by first intention, it is not covered with iodoform but properly drained and sutured, the iodoform to be only embodied in the dressing. With small wounds of this kind which promise but little discharge, it is sufficient to cover a piece of absorbent cotton somewhat larger than the wound area with iodoform and fasten it on. To large wounds however, such as amputations, goitre and other large tumor extirpations, it is necessary to apply an iodoform dressing material which readily absorbs, and permits the passage through of the discharge, and is not so liable to plug the drainage tube

openings, as the cotton. For this purpose iodoform gauze is best suited.

Whoever has tried cotton exclusively as a dressing will have noticed that it only absorbs and allows the discharge to pass through it to a certain extent. Where large amounts of discharge should be absorbed by the dressing, even the best absorbent cotton refuses to be of service. This is clearly due to the fact that it acts as a filter. The pus and blood corpuscles and fine particles of tissue are retained in the close meshes, collect more and more, and finally pack together into a thick, impenetrable mass. And this happens at the very place where the largest quantity of discharge should pass through, that is, around the tube openings. As a result, the latter become easily stopped up, and retention of discharge is the unfailing consequence.

The dressing-gauze does not possess this disadvantage. Its wide meshes permit the passage of all fine particles in the discharge

and therefore assure its even distribution throughout the dressing. It is not exactly necessary for the latter to consist of gauze alone. It suffices when the immediate vicinity of the wound is covered with a number of folds. This works like a wide sieve, and thereby insures a thorough distribution of the discharge. It also does not appear to me that hydrophyl gauze is indispensable, as the function of the gauze is not so much to absorb the discharge, as to allow it to pass readily through its meshes. As a result of these facts, since the first of this year all wounds intended for primary union, and latterly all wounds of whatever nature, at Billroth's clinic have first been covered with a layer of iodoform gauze and then with an absorbent cotton dressing. The preparation of iodoform gauze, which by the way, was first made on Billroth's clinic, is very simple, and as no particular apparatus is needed, can easily be undertaken by every physician.

A quantity (2-3 metres) of very loose undressed cotton, or gauze, should be loosely folded, handkerchief-like together, and laid in a washbasin which has been previously disinfected with a five per cent. solution of carbolic acid. Powdered iodoform should then be shaken over this from the powder-box and thoroughly rubbed in with the hands, which should likewise have been thoroughly disinfected. It should be done as if the material were being washed. When the iodoform has been disseminated as evenly as possible, the gauze should be finally shaken over the basin so that the superfluous powder may fall out. The gauze is now finished, and after being folded should be put away in closed vessels. Gauze thus prepared contains, according to the degree of shaking out after manipulation, anywhere from ten to twenty per cent. of iodoform. It always suffices where it is to serve as an occlusive dressing where, therefore, it is to replace the Lister. For many purposes, however, as

in the treatment of wounds connected with mucous tracts, it is desirable to use a gauze containing more iodoform, for through the abundant discharge occurring in some places, as in the mouth, it might happen that a considerable amount of iodoform would be washed out or carried away mechanically. For such purposes we have from the first used gauze prepared by Bruns' method. First heating it with a solution of four parts resin, one part glycerine and one part alcohol. It is then dried and prepared like the weaker gauze. The iodoform adheres here in a much larger quantity, from thirty to fifty per cent., and more firmly, so that but a small proportion of it can be removed mechanically. A second advantage is that it is also somewhat stiff and adhesive. As a result of this, the strips of gauze used in filling a wound pack readily into an adherent mass, which is, nevertheless, completely permeable. It also adheres to the wound surface which is of

particular advantage in certain localities where such tampons are apt to fall out.

If a large wound is to be dressed, which should heal by first intention, a piece consisting of from four to eight layers of the ten to twenty per cent. gauze should be taken, and should be just large enough to overlap the wound a little, half an inch to an inch, in all directions. Over this comes a sufficient quantity of cotton and waterproof material and a bandage. This "iodoform-occlusion dressing" I will return to later.

Iodoform staffs or suppositories (*Baccilli Iodoformi*) find extensive application.

They are prepared by adding to iodoform an adequate amount of cacao butter, mucilage and glycerine, or also gelatine.

Thus :

R. Iodoformi pulv. 10.—
Mucilag, Gummi Arab.
Glycerinæ, āā —

pauxill. ut fiat massa ex qua form baccilli — longit —

The same formula without glycerine gives very hard brittle staffs which are also useful.

R. Iodoform pulv. 5.

Gelatini 10.

Form, bacilli crassitud—longit—

R. Iodoform pulv.

Butyri caco.

aa part, æqu.

These staffs are extremely useful for many purposes, as for instance, where it is desirable to introduce iodoform into fistulæ, deep wound cavities and cavities of the body difficult of access, as the uterine, and that of the urinary bladder.

As fluid I have applied iodoform in two forms.

I. As ethereal solution.

R. Iodoformi 5.

Æther 25.

D. ad vitr. cerul.

In this form I have used it with good results as parenchymatous injection in fungous inflammation of joints.

II. As suspension.

R. Iodoformi pulv. 10.
Ol. olivæ 40.
Glycerinæ 80.

D. S. Shake well before using.

The suspension I have used for injecting into the nares, urinary bladder and into previously emptied cold abscess cavities. Of this I will speak later. Besides the methods of application already mentioned iodoform may be used as an ointment, one part of iodoform to ten or twenty parts of ointment.

If it is here also desirable to deodorize, a few drops of some aromatic oil should be added such as, Ol. Bergam., Ol. Menthi, Lavand, or Cinnam. Auspitz recommends carbolized iodoform ointment, which has but little odor.

R. Iodoformi pulv.
Acidi carboli ã 20.
Ung. 150.

The iodoform collodion recommended by

Moleschott is very useful and should be applied with a brush to the skin. It is especially useful for acute and chronic gland swellings, for neuralgia, and different kinds of inflammatory exudations. I also recommend it for lymphomata.

PART II.

IODOFORM IN THE TREATMENT OF FRESH AND CLEAN (ASEPTIC) WOUNDS, AND NEGLECTED WOUNDS AND SORES.

HAVING become acquainted with the application of iodoform in general, let us now go more closely into its practical application to wounds.

In order to have a clearer view, we will divide the different kinds of wounds into three main categories, in each of which the iodoform will have a different part to perform.

A. Fresh and clean (aseptic) wounds:

B. Septic, infected wounds and sores.

C. Wounds and sores of a specific nature, tuberculous, scrofulous, lupous and syphilitic.

A. Fresh and clean wounds. In beginning with this category we must divide the wounds belonging to it into groups, namely, *a.* open wounds with loss of substance, mechanically unsuited for primary union; *b.* wounds wholly or in greater part suited for primary union; *c.* those communicating with the peritoneal cavity; *d.* those communicating with a mucous tract. To this last belong all wounds of the mouth, pharynx, nares, rectum, vagina and urethra.

As most operation wounds, as well as accidental ones, so important to the practitioner, belong to these four divisions, I must still premise a little in regard to the antiseptic measures which should be strictly observed before putting on the iodoform dressing.

That the spray is to-day to be regarded as superfluous, I have already mentioned.

Now, especially, the practitioner can feel justified in abandoning its use. The observance of all other antiseptic precautions, however, is so much the more necessary.

The surroundings of the wound, and everything that is to come in contact with it, must be thoroughly disinfected with three per cent. carbolic solution, and if the wound be one for which the antiseptis is vitally important, the five per cent. solution should be used wherever its corrosive action is not actually harmful. For the disinfection of instruments, I advise you to use the five per cent. solution. The greatest care should be taken with the sponges; they should be thoroughly washed in warm water, and soaked at least five days in five per cent. carbolic solution. If no reliable sponges are at hand, use cotton wads soaked in three per cent. carbolic solution for cleansing the wounds. Drainage tubes should also have lain several

days in five per cent. carbolic solution before being used.

For ligatures use catgut, or what will probably be much more convenient, antiseptic silk, which should besides serve as the only material for sutures. This should be prepared according to Czerny, by winding the surgical silk on spools, boiling it one hour in five per cent. carbolic solution, and preserving in solution of the same strength. This silk produces no inflammatory reaction, and a ligature does not interfere with primary union.

At conclusion of the operation, every wound should be irrigated with three per cent. carbolic solution.

Still other details are always to be attended to, but their consideration here would lead me too far.

Let us now consider the earlier introduced groups of wounds.

a. Fresh open wounds. I begin with this sort of wound because owing to its sim-

plicity the iodoform dressing can be best studied and judged with it.

Let us imagine that we have removed a superficial tumor, and cut away so much skin that the wound be not at all, or but slightly brought together with sutures. You have before you an open loss of substance which can only heal by cicatrization from the edges. Here the simplest sort of iodoform dressing, as I have before described it, is sufficient. A very thin layer of iodoform should be applied to the wound, and this covered with a sufficient amount of absorbent cotton, and then with a piece of waterproof material, (protective) and the whole fixed with an ordinary bandage. This dressing can be left on a week without causing trouble. If discharge appears at the edges during this time, it is simply necessary to add fresh cotton.

At the first change of dressing a moderate amount of bloody, serous and almost odorless discharge is found. The iodoform

still clings quite firmly to the wound, which is not at all irritated and is entirely painless. The patient is from the time of the operation free from fever, never complains of pain, and feels well generally. By the next change of dressing, which is first necessary at the end of the second or during the third week, the entire wound is plainly cicatrizing from the edges towards the centre. The secretion is slimy, serous, and very small in quantity. The patient always thoroughly well. The iodoform dressing should now be replaced by an ointment under which the further cicatrization goes on.

In place of the powdered iodoform, iodoform gauze may be used for the first and second dressings as in the following groups of wounds.

In the manner described, I have seen a large number of cases, in part severe operations, run a completely smooth course, and from this experience I can say in regard to the iodoform dressing the following :

Applied to fresh wounds, iodoform exerts absolutely no irritant action and insures a completely aseptic course. All symptoms of general reaction are absent. As long as the iodoform remains in contact with the wound the discharge is very slight and serous in character. During the first week the iodoform adheres quite firmly, and first separates when granulations begin to develop beneath it. The dressing needs to be changed but weekly, seldom oftener.

I must here remark, that for a wound which is already clean and granulating well, iodoform is not always an advantage. Owing to the lack of every irritation, the further progress in healing, particularly the cicatrization seems to go on slowly. The granulations become very tender, and at times so hyperæmic that they bleed from the slightest disturbance. I decidedly advise, therefore, to omit the iodoform dressing as soon as the wound granulates well.

It is then best to apply a mildly irritating ointment.

R. Argent. Nitr. 1—100.

To this class of wounds also belong deep wound cavities with a free external opening. Such, for instance, as remain after extirpation of the eye. In such cases the entire cavity should be filled with gauze, a wad of cotton fastened on outside, and the wound otherwise treated like a flat wound. The closest attention, however, should be given to one particular, which is, the necessity of bringing all parts of the wound in direct contact with iodoform. A large space should never be left which is free from its action, as the discharge could easily collect there, decompose, and make the entire effect of the iodoform dressing illusory. In wound cavities connected with a mucous tract, of which we will speak later, such a collection of discharge would be particularly harmful. In some such cases I have noticed on the third or fourth

day a slight rise in temperature, and found on removing the dressing that it was due to discharge detained behind the gauze. It is necessary to be particularly careful in this direction, after a wound has been firmly tamponed to arrest bleeding. In such cases as a precautionary measure, the dressing should be changed on the second or third day and the gauze laid in loosely.

b. Wounds which are suited for primary union.

In connection with this class of wounds, I must before all, point to the earlier mentioned antiseptic precautions, which should always precede application of the iodoform dressing. I will once more emphasize the fact, that wounds intended for primary union must, under the iodoform dressing also, be regularly drained and carefully sutured.

The dressing is as follows: The wound is first covered with a piece of iodoform gauze from four to eight layers thick,

which should not overlap it more than two to four centimetres in all directions. Over this comes a piece of absorbent cotton corresponding in size to the amount of discharge expected. This should be completely covered with waterproof material, and the whole fixed with a bandage, over which may still be applied, if indicated, a starch or elastic bandage. The relatively small amount of iodoform gauze, is sufficient to assure asepsis even in abundantly discharging wounds. For all discharge in escaping, must pass through the layer of gauze, and take up exactly what iodoform is needed to protect it from decomposition. Now, while iodoform is exceptionally little soluble, and small quantities of it suffice, nevertheless, to prevent decomposition, the supply stored in the gauze furnishes the wound with an antiseptic magazine which can not be easily exhausted. As this magazine always lies directly on the wound, it forms at the same time a barrier

against invasion from without, and it is therefore immaterial whether the discharge in the outer part of the dressing in the cotton decomposes, or not. On this account, staining through does not need to be so anxiously watched for, nor the dressing to be so frequently changed. That these properties of iodoform increase safety to an extraordinary degree, I have already emphasized. Indeed, compared with the Lister dressing, it is correspondingly greater, as the carbolic gauze, owing to the ready solubility of the acid can be easily exhausted by the discharge. The total removal of the carbolic acid will occur soonest in the part of the dressing lying directly on the wound, where the largest amount of discharge passes. These layers are thus easily deprived of their antiseptic, so that they can scarcely be expected to offer resistance to the action of septic processes invading the wound from without.

This, a priorily deduced advantage of

iodoform gauze, I have seen completely confirmed in a large series of cases.

I have seen large numbers of operations on Billroth's clinic, heal as smoothly and surely under the iodoform dressing, as with the most faultless Lister. Among them were large amputations, osteotomies, thyroid extirpations and breast amputations, as well as extirpations of large tumors in different regions. It would lead me too far, were I to bring individual cases from these observations before you. I refer those of you particularly interested in this phase of the iodoform treatment, to my detailed paper, published in the *Berliner Klinische Wochenschrift* (1881, Nos. 49-50).

The course of the wound healing, as well as the reaction on the part of the entire organism, is exactly as favorable if not more so, under the iodoform dressing as under the Lister. The discharge is only considerable in the first twenty-

four hours, later it is slight, slimy, serous and odorless. The wound is not in the least irritated, and entirely free from pain, and the patient is without fever, excepting slight rises in temperature which often appear during the first few days, but do not disturb his well-being.

As already mentioned, the iodoform dressing does not need to be changed as often as the Lister. Large wounds, as those for instance after amputation of upper extremities, thyroid extirpation, etc., heal completely under from two to three dressings. It is best to change the first dressing on the fourth or fifth day, and at the same time remove the sutures, and as soon as the healing goes on undisturbed, the drainage tubes also. The second dressing may remain at least a week, and often until complete healing has taken place. If there are no drainage tubes to remove, you can allow the first dressing to remain on from ten to fourteen days, that is, until

the healing is completed. You then have a permanent dressing, as applied years ago by Neuber, on Esmarch's clinic, with carbolyzed dressing material.

According to our present experience it can surely be maintained that the iodoform dressing is capable of entirely replacing the Lister. Besides this, it presents the advantage of greater simplicity and increased safety, and therefore deserves preference.

These advantages appear of particular value to me in the treatment of compound fractures and gunshot wounds, which, by the way, are apt to come to every practitioner, and which he must, in the beginning at least, take under treatment. I should, therefore, like before leaving this group of wounds, to inform you in regard to two cases of compound fracture and one of gunshot wound occurring in my private practice; in order to show by them how I would advise you to proceed

in similar cases. The first case was a compound fracture of the femur in a man of about fifty years, who had been kicked by a horse. The skin wound was on the outer side of the thigh and separated from the point of fracture by an enormous extravasation. As the wound was small and the fragments had protruded from it neither during nor after the injury, and I was on hand one hour after the accident, there was no ground for supposing the deeper parts to have been infected from without. I therefore contented myself with washing the wound and its vicinity with five per cent. carbolic acid solution, and clearing away only the superficial parts of the clot. I then dusted the wound with iodoform and applied the regular gauze dressing. Under two changes of dressing the wound was healed, and the further progress of the fracture went on without interruption in the extension apparatus.

The second case, a patient of eight years, was also kicked by a horse, the injury being on the front of the leg. I was called in consultation by my colleague, Dr. Klein, and arrived three hours after the accident. Both bones were broken at about the centre. Over the anterior surface of the tibia was a skin wound about seven centimetres long, through which both ends of that bone, denuded for a long distance of periosteum, protruded. The wound was covered with dirt and particles of horse manure. The clothes were also cut through. It was evident that a thorough *debridement*, according to Volkmann should be done. I therefore enlarged the skin wound, laid both ends of the tibia completely bare, removed bone splinters, cut off all projecting points, and washed the entire wound with five per cent. carbolic acid solution. The ends of the bones were then adapted. The skin wound, however, only limited by two sutures at either

end, so that there still remained, reaching down by the bared bones, an opening five centimetres long and one half to one centimetre wide. This I filled with iodoform powder, and applied the regular iodoform dressing with a few turns of starch bandage. No drainage tube. The course was completely aseptic. No fever throughout. The dressing was changed but twice (on the 10th and 29th days). After six weeks the patient went about with splint and starch bandage.

The third case was a revolver wound of the forearm in a boy of about ten years. The projectile about seven m.m. in diameter had grazed the ulna in the neighborhood of the elbow joint and lodged, according to my calculations, close to the interosseous membrane.

I proceeded here exactly as in case number one. The blood clot obstructing the shot canal was only superficially cleared away, the wound and vicinity washed with five per cent. carbolic acid solution, the

wound dusted with iodoform, and the regular iodoform gauze dressing applied and supported by a splint. The first dressing remained on fully twelve days. On change of dressing, I found a small, cleanly granulating wound. Neither local inflammation nor general reaction followed. The boy had during the recovery no considerable pain, and could move the arm quite freely after twelve days.

I call your attention to the fact that the projectile was not removed, and also that no attempts at removal were made. This was intentional, as I think our principles of gunshot wound treatment must be with regard to modern antisepsis, essentially altered. First of all, we must hold fast to Esmarch's principle of not disturbing the wound. All attempts at probing and extraction should be avoided. If something must be done, the most thorough antiseptic precautions should be taken. As all shot wounds incline to primary union, and the

projectile does not interfere as a foreign body, the advisability of at once making attempts at extraction after every shot wound is questionable. Through the introduction of instruments into the wound the requirements of first intentions are much interfered with and danger is much increased. Bergmann and Reiher's experience in the last Russian campaign showed, that through purely conservative treatment, that is, avoidance of attempts at extraction, application of an antiseptic dressing, and immobilization of the wound in the simplest manner, the best results thus far have been attained. Bergmann observed one case in which even rags carried into the knee joint did not disturb the result, but healed in without reaction.

More extensive experience must indeed be collected before we can advise universal avoidance of attempts at removal. Immediate extraction of the bullet will be often enough indicated. In general, however, I

would advise you to act according to the above principles. At first only pay attention to the antiseptis and do not trouble yourselves about the projectile. You thus take the surest and simplest course. Should extraction later prove necessary, it is done under much more favorable circumstances when the wound has completely healed, as you then operate in healthy tissue. The bloody suffused parts around a fresh shot wound, not only make the operation much more difficult, but also increase extremely the danger of septic and pyæmic processes.

c. Wounds communicating with the peritoneal cavity.

The iodoform treatment again proves its value when used after operations necessitating opening of the abdominal cavity. It has been used on Billroth's clinic after numerous ovariectomies, hysterectomies and stomach and intestinal operations. As, however, laparotomies carried out on the

principles of to-day are but little influenced by the dressing, this experience is of slight value as regards the worth of the iodoform dressing. One of the first principles, as acknowledged by most surgeons, is to close the cavity completely, when possible, after operation. We, therefore, return the pedicle after ovariectomies and renounce drainage, which, owing to the peculiar relations of the peritoneal cavity, is of doubtful value. As soon as we have completely closed the peritoneal cavity, the patient's fate is decided, and the dressing has as little effect upon the recovery as most of the supplementary measures practised. In a trip made for study, three years ago, through France, England and Germany, I had ample opportunity to convince myself how important a role the dressing plays in laparotomies. With one ovariectomist the entire dressing consisted of a small piece of gauze, fastened on with two pieces of plaster. The other on the contrary applied

a colossal occlusion-dressing taking in the entire abdomen and part of the thighs. Everywhere the healing process went on equally well, if all antiseptic rules were strictly observed during the operation.

Although iodoform plays a less important part in laparotomies as a dressing, a manner of using it first indicated by Prof. Billroth, for certain difficult cases of abdominal operation, is of the greatest importance, and may bring about new and great progress.

As is well known, it is a serious complication of all laparotomies when large wound surfaces are left behind in the peritoneal cavity. Such surfaces are most dangerous in the deep portion of the cavity, the pelvis, namely. The great danger of this complication is recognized by all experienced operators, and various measures have been adopted to control it, without our having found until now, a successful one. The danger consists essentially in the fact

that the secretion from the large wound surface collects in the deep parts of the peritoneal cavity, easily decomposes, and leads to "spontaneous infection," as I have named this sort of infection of the entire peritoneum. Owing to the peculiar relations of the pelvic cavity, the aids otherwise applicable for the avoidance of such decomposition centres, "dead spaces," namely, drainage and compression, can be applied but imperfectly. I published last year a detailed treatise in regard to this subject to which I refer those of you more nearly interested in it.*

In severe cases of this sort Billroth proceeds as follows: After completing the peritoneal toilet, the large wound surface which often covers the entire small pelvis and part of the large, is dusted with a thin layer of iodoform, or simply wiped off with

* I. Über die Anwendung der Antisepsis bei Laparotomien, mit besonderer Rücksicht auf die Drainage der Peritonealhöhle, (Von. Langenbeck's *Archiv*. XXVI.)

some of the fifty per cent. gauze, whereby a certain amount of iodoform is left behind.

The intestines are then immediately laid over this and the abdomen completely closed. The "dead space" thus left in the pelvis is supplied with a quantity of iodoform, which for a long time prevents decomposition, and consequently spontaneous infection of the peritoneum.

d. Wounds communicating with a mucous tract.

Aside from the method of applying iodoform just described, we have as yet only considered wounds in which, at least as regards the result, the Lister dressing has reached the highest degree of perfection, so that here a further progress has only been obtained through a more simple technique, and a safer and cheaper dressing material, and we have preferred the iodoform dressing on these grounds only.

In the group of wounds now to be considered, Lister's method can be not at all or only very incompletely applied, as one of the principal conditions of the dressing, exact occlusion, cannot be carried out. As a result, we have until now, either been entirely unable to obtain an antiseptic wound course with such wounds, or have only done so by making use of the most complicated, and often untrustworthy, means.

This was the case with most large wounds communicating with the mouth, nose, pharynx and intestines, and particularly with those involving the rectum, vagina, bladder and urethra.

I can say at once that in iodoform we possess the means with which to assure for wounds of this sort, just as certain an antiseptic course as the Lister enables us to for those that can be completely isolated, and that consequently the iodoform treatment promises for this class of

wounds the same reform which the discovery of Lister introduced for the preceding groups.

Let us next turn to wounds of the mouth and pharynx.

Every surgeon knows how hard it has been to prevent decomposition of the saliva and wound discharge, even after a small operation in the mouth. What operator does not know the great danger to which every patient was formerly exposed, after extensive operations in the mouth. Precisely during the first and most important days it was hardest to prevent decomposition of the discharge, and therewith all the dangerous sequelæ, such as septic phlegmon, wound diphtheria, deglutition pneumonia, pyæmia, etc.

Let us now take as a special example, extirpation of lingual cancer, a more or less typical operation. How dangerous this operation formerly was is best told by Stromeyer's familiar speech: "Humanity

loses nothing thereby if such operations are left undone, and surgery is not honored by them." In Billroth's clinic the mortality after extirpation of lingual cancer, amounted during the years from 1871 to 1876, to thirty-two per cent., and Von Bruns had during the same period a mortality of 37.8 per cent.

Latterly the results appear to have continually improved. With the aid of exact drainage, by thoroughly coating the mouth with permanganate of potassium, and frequently syringing day and night, the mortality was reduced, on Billroth's clinic, from 1877 to 1880, in fifty-three operations to 17.6 per cent. But still, this number was large enough, and the complicated after treatment very wearing for the patient and burdensome to the physician and attendants. The practice hitherto followed in the treatment of lingual cancer, you will find accurately described in an excellent paper by my

from the mouth, no surrounding inflammatory action, no important rises in temperature, and no bronchitis or pneumonia; in short such an ideal course as had, with such simple methods, scarcely ever been seen.

A similarly smooth course is obtained with the iodoform treatment after all operations in the mouth, namely, after resection of the upper or lower jaw, and further after operations in the pharynx, larynx and œsophagus. Here, too, the entire treatment consists in tamponing the wound with iodoform gauze, which mostly remains as long as after the already described tongue operation. I should remark that in many locations, as in the tonsillar region the tampons adhere less tenaciously and become easily loosened through efforts at swallowing. In such cases they should be fastened with thread and loops externally to prevent their being swallowed. If they become loosened they should be replaced by new ones every second or third day.

The certain asepsis which iodoform assures in the nasal cavities as well, I observed in the following case :

A patient with a very vascular sarcoma of the upper jaw was admitted into Billroth's clinic. During examination of the nares, into which the ulcerated, readily bleeding growth protruded, such an abundant hemorrhage suddenly came on, that it was necessary to tampon. In attempting after several days to remove the tampons, a similar hemorrhage occurred so that tamponing again became necessary, and this was similarly twice repeated. We could no longer afford to expose the extremely anæmic patient to the danger of further hemorrhages. I therefore allowed the tampons to remain fully two weeks without being disturbed, until the patient had partially recovered from loss of blood. When I finally removed them, there had been no hemorrhage in the meantime, the iodoform gauze saturated with blood and slime was

entirely free from odor and had produced no inflammatory action.

No less favorable are the results obtained with iodoform after operations on the rectum. Before all I recommend the remedy to you for the after treatment of the so frequent anal fistula (rectal fistula). In several cases, where it is necessary to make very extensive and high division, it is of particular advantage. In all cases the fresh wound should be packed with the fifty per cent. gauze, and this allowed to remain from five to eight days, during which time the stools should be controlled with opiates. At the end of the first week the original gauze strips are passed with the first stool, and the dressing must then be changed after every movement. The strips remain odorless and every sign of inflammation is absent. It must be very evident that patients in this way suffer scarcely any pain, and feel much more comfortable than when the dressing is changed daily. As soon as the

wound granulates well it is best to replace the iodoform with a salve dressing.

Iodoform is also used with the best results after the serious and involving operations for cancer of the rectum. It would lead me too far to go more closely into the after treatment of these operations, which belong to the most difficult chapter of operative surgery. I will only remark that here the essential part of the iodoform treatment is to fill the spacious wound cavity with iodoform gauze tampons, and allow them to remain a long time, even over a week. This, too, without seeing the anti-sepsis disturbed, in spite of the passage of fæces.

Two instructive cases from Billroth's clinic show that an almost absolutely aseptic course may also be obtained by the iodoform treatment in wounds connected with the urinary tract. They concern two patients with far advanced cancer of the penis. In less advanced cases Professor

Billroth had used the Thermo-cautery alone, but it was here necessary to dissect out the penis nearly as far back as the origin of the corpora cavernosa, and remove the latter with the Thermo-cautery. A cuff-like skin flap was left, and there remained a circumscribed wound, surrounded for the greater part by loose cellular tissue, in the depths of which lay the urethral orifice. In both cases this cavity was simply filled with gauze, which in the second remained over a week. In the first case a catheter was used on the third day, and in the second none during the entire progress. The urine was from the first passed spontaneously by the patients, and drained through the gauze. Here also, all signs of decomposition, odor and inflammatory action were absent. The patients were able after a few days to leave their beds, and in the second week the wounds were filled with clean granulations.

Finally, belong in this category, wounds following gynæcological operations. In Billroth's clinic, the after treatment of a series of uterine extirpations was also carried out with iodoform, and throughout an almost entirely smooth progress obtained.

Iodoform is also valuable after other gynæcological operations.

B. Septic Wounds and Sores.

While the application of iodoform to fresh wounds is entirely new, it has been used by many surgeons and with the best results in the class of wounds now to be spoken of. Notwithstanding the fact that it presented eminent advantages for so many such cases in daily practice, the remedy obtained no general recognition. I will be permitted, therefore, to dwell somewhat longer than otherwise upon this group of wounds.

Iodoform can be used for every septic wound, every ichorous sore, with great advantage, as it is able to arrest decom-

position in the shortest time. If you have such a wound or sore before you, it is only necessary to powder it with iodoform or cover it with the gauze, in order to check in the shortest time, often in a few hours, all local septic processes, and therewith cause all symptoms produced by them to disappear almost as rapidly.

While as we know iodoform only acts locally, we must carefully observe that it comes in contact with all parts of the ichorous surface. Although it is a relatively weak antiseptic it works where this can be done as a result of the constancy of its action, more surely and rapidly than all other ever so powerful antiseptics, and at the same time offers the great advantage of not irritating the tissues like the stronger ones.

Iodoform is next to be recommended for all neglected wounds after accidental injury. The wound should be laid open,

cleansed, and dusted with it, and over this the iodoform dressing applied. As a rule on the following day every trace of odor has disappeared, the discharge lessened, and the pain mostly subsided.

Particularly striking is the action of iodoform on gangrenous wounds. The demarcation and separation go on under its influence entirely without odor, even when putrefaction has preceded. The following case from Billroth's clinic, was very instructive to me.

A woman was bitten in the index finger by a squirrel, whereupon a phlegmon developed within a few days, which extended to the forearm. After eight days the entire hand and part of the forearm were intensely swollen, and the index finger gangrenous up to the middle of the first phalanx. The patient had suffered intense pain for several days which refused to cease even after I had made abundant incisions and evacuated the foul smelling discharge from

the suppurating tissues. Two days after this I dusted the gangrenous finger as well as all the incision wounds with iodoform, and after twenty-four hours all odor and therewith the pain had disappeared. The phlegmon was arrested and separation of the gangrenous finger went on without interruption.

I treat the daily occurring felons and other paronychia, in the same way with the best results, and also subcutaneous phlegmon of the extremities. In deep phlegmon iodoform strewn superficially upon the wound can exert no influence. In such cases after deep and free incisions, strips of iodoform gauze should be introduced into the deep-lying pus cavities. I would also advise, in addition, the use of that old and reliable remedy the poultice, and not to forget elevation of the extremity.

In furuncle and carbuncle the incision openings should be filled with iodoform powder or packed with thin strips of the

gauze. If the surrounding parts are much infiltrated a poultice should also be applied. In a case observed on Billroth's clinic, of anthrax of the chin and under-lip, recovery took place very rapidly under this treatment. I have further cured a phagedenic ulcerative process in a man of sixty years, which involved half a finger and part of the skin on the dorsal surface of the hand, and had resisted all other treatment. (Repeated cauterization, anti-syphilitic cures, etc.).

Experience fails me as to whether iodoform is capable of bringing once started erysipelas and wound diphtheria to a standstill. As it only acts locally it can exert but little influence on the first named.

In the treatment of neglected ulcers of the leg, iodoform is of great value. I saw it used for this purpose two years and a half ago by Lister, who described it as the most powerful and certain antiseptic for these cases. The ulcer should be powdered with iodoform or covered with the

gauze, and the requisite amount of absorbent cotton fixed over this with moderately firm compression. As a rule a clean ulcer will be obtained after several days, and this without the patient keeping his bed. This is the chief object of the iodoform treatment in these cases. The formation of a firm cicatrix must be aided by other means, principally mechanical. I have latterly used for this purpose, Martin's bandage almost exclusively. It is splendidly adapted to the out-patient treatment of this common trouble.

The use of iodoform is further to be recommended for foul new growths, such as carcinomata of different regions, which on account of the abundant secretion of a foul-smelling discharge are often such an affliction to the patient as well as those about him, and of the greatest trouble to the physician. The disinfection of such inoperable cases of cancer of the breast, penis, tongue and elsewhere, may be ac-

complished by using the iodoform powder or gauze. For rectal, uterine, and vaginal cancer, suppositories and pessaries of iodoform and But. Cacao, or gelatine with addition of morphia are useful. Within twenty-four to forty-eight hours the offensive odor and in part the pain disappear, which is a great relief to the patient and all concerned. Here you must also be sure that the iodoform actually comes in contact with the wound surface. The iodoform odor also may be covered with ethereal oils.

The preceding is not only to be recommended for inoperable cases but also for operable ones, as *preparatory disinfection*. Efforts at preparatory disinfection of the operating field in the neighborhood of foul tumors, as in the mouth, vagina, etc., were also successful formerly but never in so simple a way as with iodoform.

Finally, a description belongs in this place of the application of iodoform to cavities of the body which have become the

seat of inflammatory and suppurative processes. I first recommend it to you in the operative treatment of pyothorax. You will best understand the manner of using and the action of iodoform in this disease by the introduction here of two cases which I will now describe.

One case from my private practice was a high degree of empyema which appeared spontaneously in a boy of ten years after a left-sided pleurisy. The patient was, after a ten weeks' duration of the disease, extremely reduced, and thoracentesis thrice performed by another surgeon, had had no effect upon it. Called in consultation by Dr. Wonka I performed, according to the rules which through the efforts of König are established for the present, resection of a part of the seventh rib in the axillary line, drained and applied an iodoform dressing. In addition to this, however, I introduced into the pleural cavity, twice weekly, an iodoform staff prepared

after a previously given formula. The secretion diminished continually, after the second week lost its pussy character entirely, and was always odorless. The patient, before always feverish, remained from the time of operation without fever. After six weeks the opening was completely closed, the highly compressed lung again mostly expanded, and the heart previously much pressed to the right, once more in its normal position. The patient gained during this time about five and one half kilos. I do not mean to infer that recovery would not have occurred in this case without the use of iodoform; the certainty of the course is however, according to my convictions, decidedly assured by it.

The second case from Billroth's clinic, was a pyothorax of six years' standing, resulting from a stab wound. When the patient came to the clinic there was a sinus which had existed during this time and which led into a spacious cavity filled with

foul-smelling secretion. A long incision was also made in this case, the rib resected, drainage applied, and iodoform staffs similarly introduced twice a week. The discharge had become free from odor even after forty-eight hours. Complete recovery did not indeed take place here so rapidly; but that was scarcely to be expected after the long duration of a cavity with unyielding walls. The case only goes to show that even under such unfavorable circumstances, iodoform can develop its rapid and energetic action.

I have further made use of iodoform in two cases of purulent cystitis. After other remedies had been followed by no great results, I introduced a small iodoform staff through the urethra into the bladder. With females this can be done directly with the aid of small dressing forceps, in males the staff is to be pushed in by the after following catheter. In both cases the previously ammoniacal urine became on the third or

fourth day free from odor and acid in reaction.

Finally, it may be mentioned that iodoform staffs are used for the uterine cavity by obstetricians and gynæcologists. The staff is introduced through the cervical canal into the uterine cavity, where it soon liquefies, so that the uterine walls are everywhere brought into contact with iodoform. This application for prophylactic purposes should also be followed by good results after obstetrical and gynæcological operations, and also in already existing endometritis.

PART III.

IODOFORM IN THE TREATMENT OF WOUNDS AND SORES OF A SPECIFIC NATURE.

C. Wounds and sores of a specific nature. (Tuberculous, scrofulous, lupous and syphilitic.)

Thus far we have studied iodoform only as an antiseptic, and for this property alone have given it preference as a dressing material. We now come to a class of wounds upon which, besides its antiseptic action, it exerts a more or less decided specific, healing influence, an advantage which has not been shown in so striking a manner by any other antiseptic. That iodo-

form acts remarkably well upon sores in syphilitic tissue, and brings about recovery more quickly and surely than many of the remedies formerly used, syphilologists have already acknowledged, so that fresh evidence in this direction is scarcely needed. I refer you to the already mentioned articles by Nunn, Besnier, Ferial, Lazansky, Bozzi, Zeissl, Maracek and many others. We will, therefore, at once consider the action of iodoform upon wounds and tumors in tuberculo-scrofulous tissue, and first of all in cases of scrofulous joint and bone inflammations. As is well known, fungous bone and joint diseases are regarded to-day according to the prevailing view, that of Volkmann, as local tubercloses, which are simultaneous expressions of a general tubercular dyscrasia. Although the discussion held over tuberculosis at last year's Berlin surgical congress proved the views in regard to this question to be still far from clear, the fact still remains

that these joint diseases stand in very close relation to tuberculosis. Modern endeavors to hasten recovery through operative interference, that is, extensive resection and scraping out of the parts, are therefore *à priori* completely justified; since the introduction of the antiseptic wound treatment we have been able to undertake such measures with little danger, and have therefore hoped with the aid of the Lister dressing, to cure bone and joint tuberculosis in the earlier stages, more quickly and certainly.

Unfortunately these early expectations proved to be unwarranted. König was the first to prove by his experience with a large number of cases that extensive resection of tuberculous joints did not in general lead to brilliant results. He communicated, in the last but one of the Berlin surgical congresses, 117 cases of extensive tuberculous joint resections performed antiseptically, in the course of four years. He watched

the further progress of the cases not only for the following months, but during several years, and came to the conclusion that the operation performed antiseptically exerted no essential influence upon the later course of the disease, and especially that the carbolic acid did not act upon the tuberculously diseased tissue.

Unfortunately, every surgeon must agree with König's decision. Who has not again and again experienced, that under the carbolic dressing the healing starts brilliantly, but that after a few weeks, and even as early as a fortnight, the granulations become fungous in character, or the young cicatrix breaks down to make way for fungous masses springing up from beneath.

Furthermore, König proved, as far as his limited number of cases warranted a conclusion, that the antiseptically performed operations produced no effect on the mortality. The number of patients who died later, of tuberculosis and other resulting diseases,

was for the short period so great that it, at least, corresponded with Billroth's record of mortality for victims of joint caries.

As regards the question of local cure as well as that of general infection, König's experience appears to speak decidedly against early resection, much as we would wish through it to prevent general infection by the earliest possible elimination of the tuberculous process. Considering the old experience that in so many fungous bone and joint diseases, especially in children, spontaneous recovery occurs, we must designate the necessity of early operation, at least for a series of cases, as doubtful; and indeed I believe that iodoform also can hardly cause any essential change in this particular. Where and to what extent fungous joints should be resected will best be decided in the future, after learning whether the later function of the limb is best after resection, or purely conservative treatment. In Billroth's clinic for years, all cases where

operative interference was not absolutely indicated, have received only conservative treatment; that is, spontaneous recovery has been aided by mechanical helps, such as extension, immobilization, supports, etc.

The relations are different, however, in those cases where abscesses threaten to break through, or have already done so; where sinuses exist, or extensive disturbance in the bone and joint is evident. Here, even the surgeon devoted to purely conservative treatment must interfere in some way. Still such cases have unfortunately thus far given no great satisfaction. In spite of the strictest antiseptis, primary union of the soft parts very often fails to take place, and extensive operation therefore promises but little success, and often becomes dangerous. In addition, is the fact that with weak patients, children namely, there is danger of intoxication from a too intense action of the carbolic acid. Thus it happened, that we limited ourselves in

these cases mostly to curetting and removal of sequestra. In short, to slight operative measures, and as our former antiseptics did not affect the character of the tuberculous granulations, and a cavity surrounded by bony walls was from mechanical causes able to heal but very slowly, we were often driven in the end to amputation as the only radical aid.

To-day the state of affairs is essentially changed, as we possess in iodoform a medium, which in its antiseptic action exerts a special influence on tuberculous tissue, and brings about the development of healthy granulations which heal like those in normal tissue.

There can no longer remain any doubt as to the very favorable action of iodoform upon tuberculously diseased tissue, as to-day, besides Von Mosetig's original observations and the experience on Billroth's clinic, other harmonious communications from prominent surgeons lie before us, and

I can therefore omit the introduction here of a series of striking cases as proof thereof. Differences of opinion are only possible in regard to the explanation of this peculiar action. König,* for instance, does not believe that iodoform exerts any specific antituberculous action upon the granulations, but that the influence is due to the general and peculiar antiseptic action of the drug. Which explanation is correct, will have to be decided by further research. From a purely practical standpoint, however, this is of little importance, and we may satisfy ourselves, meanwhile, with the generally recognized fact that iodoform is at present the best dressing for fungous bone and joint diseases.

Through Von Mosetig's discovery, many cases of this disease have become amenable to treatment, and by such simple means that every practical physician can make use of them. The simplicity does not refer to

* *Centralblatt für Chirurgie*, 1881, No. 48.

the technique of the dressing alone, but to the operative measures as well, the proper performance of which depends neither upon close attention to fine anatomical points nor particular manual dexterity.

Let us imagine one of the most frequent cases of this sort — a fungous disease of the ankle joint. At one point the skin is bluish red and thin, beneath it is found a plainly fluctuating abscess. The instruments needed for operation are a scalpel, curved scissors, two retractors and a large and small curette, and it is well to keep at hand for emergency, artery forceps and ligature director, hooked forceps, dissecting forceps, dressing forceps, and needle with suture; still, as a rule, they will not be needed.

The patient is anæsthetized and it is also well to empty the extremity of blood, as everything can be much better seen, and the entire operation performed without losing a drop of blood. To anæma-

tize it is not necessary to envelop the entire extremity with an elastic bandage, it suffices to suspend it from three to five minutes until it becomes entirely pale, and then bind it securely at the proper place with an elastic bandage. Antiseptic precautions must here also be strictly observed by washing the operating field with soap and water, and then disinfecting with three to five per cent. carbolic solution. The operator's hands should be similarly treated. Instruments should come from a five per cent. carbolic solution. For cleansing the wound it is best to use cotton wads which have been soaked in three per cent. carbolic solution and then squeezed out.

You now open the abscess throughout its extent, let the wound flaps be held back with retractors, and at once take in hand the curette, which is the main instrument in this operation. With it you scrape away from the bone and soft

parts all fungous matter, until you come everywhere upon sound tissue. You need not fear removing too much with the curette as only the diseased tissue gives way to it. Healthy tissue resists this instrument, and it is therefore very easy to define with it the boundary line between healthy and diseased tissue in bone, as well as in soft parts. If the primary incision was too small do not hesitate to enlarge it upon the director in the required direction, as you thus get a clear view of the entire diseased mass and can reduce the wound later with sutures. Now take the curved scissors and cut away all ragged pieces in the wound cavity as well as the thin edges of the skin flaps. If you find a small sequestrum in the wound, which is often the case, remove it with the curette or dressing forceps.

If you have a sinus and not a closed abscess to deal with, enlarge the wound

from it as a starting point, and proceed in the same manner.

If the wound was very extensive, unite it at the ends only, with one or two stitches, and always leave an opening corresponding in size to the wound cavity.

The course of the operation is essentially the same whether you undertake to scoop out a small circumscribed mass, or remove disease involving the whole joint. Extensive surgical measures are only necessary in advanced degeneration of the larger joints, and they then consist as a rule of the typical resections, and require a sure operative technique.

The after treatment also is the same. If you have a small wound before you, it is best to fill it with iodoform powder. Large cavities on the contrary, I advise you only to tampon with strips of iodoform gauze and allow the ends to protrude from the wound. Drainage tubes

are mostly superfluous. Entire filling of the wound cavity with iodoform powder would too easily expose the patient to the danger of poisoning.

The remainder of the dressing consists of absorbent cotton, a water-proof material (protective), and a bandage. If you have operated under local anæmia, you must put on the dressing with considerable compression before loosening the elastic bandage, and suspend the extremity from one fourth to one half an hour, whereby you can almost always prevent serious after bleeding.

The further progress is very simple. Above all the healing process is entirely aseptic, which can scarcely surprise you now that you know iodoform sufficiently as an antiseptic. Excepting slight rises of temperature in the first few days, the local and general reactions are practically null. In the first dressing you find the discharge to be quite abundant and bloody,

but it is afterwards very moderate, serous in character and free from odor. The patient suffers no pain and feels generally well. The dressing needs to be changed at most but once a week. In short, the wound healing goes on almost as in normal tissue. You now notice from one dressing to another that the gauze is being gradually pushed out of the wound, which is correspondingly filled with granulations. At first the iodoform and gauze cling quite firmly to the wound surface, but can however, as a rule, be easily removed by the second week, and we find beneath them clean beautiful granulations. According to its size the wound is filled in from two to six weeks, and recovery is in most cases thereby assured. Here, too, the iodoform dressing is generally replaced towards the end by a salve dressing and adequate stimulation.

The rapid filling of cavities in carious bone under the iodoform treatment is

particularly astonishing. Formerly although superficial defects of bone healed readily by drawing in and fixation of the surrounding soft parts, central cavities in carious bones and joints defied all methods, and the most favorable cases lasted months and even years before recovery ensued. Under the effect of iodoform, however, such cavities often fill rapidly so that here also recovery follows as if the defect were in normal tissue.

With similar results iodoform can be applied to other tuberculous and scrofulous diseases amenable to surgical treatment. Next of all, in superficial cold abscesses in different regions. These should be thoroughly opened, the abscess scraped out, the cavity dusted with iodoform, sewed up in part, and an iodoform dressing applied, drainage being inserted in large cavities. You proceed similarly and with like results with suppurating lymph glands, tuberculous masses in the testicle, in the neighborhood of the rectum, and elsewhere.

After such experience it is easily understood why most surgeons are inclined to believe that iodoform exerts a specific action on tuberculously diseased tissue, that is, changes it into healthy tissue, and thus acts to a certain extent as an anti-tuberculotic. The objection might now be offered, that as in nearly all cases the fungous masses were first removed by operative means, there could be at most allowed to iodoform the property of preventing quick recurrences. At Billroth's clinic we also indulged at first in the same reflections, and on that account applied iodoform directly to fungous granulations and tuberculous abscess membranes, without preparatory curetting. A specific action was shown nevertheless here, as clean granulations formed very soon under the iodoform.

That this method of treatment is not adhered to is owing to the fact that recovery occurs more slowly without previous mechanical removal of the fungous masses.

The action of iodoform is, in fact, according to my experience only local, that is, exerted only upon that tissue with which it comes in direct contact. Von Mosetig indeed observed in some cases a distant action, that is an influence upon distant diseased masses, but I have not yet been able to confirm this. On the contrary, I observed in several cases the appearance of new fungous masses even in the immediate neighborhood of the applied iodoform, which speaks decidedly against its having any general action. We were also unable at Billroth's clinic to verify any general anti-tuberculous action. During the iodoform treatment one individual died of pulmonary tuberculosis, and another of tubercular meningitis.

The specific action of iodoform as well as being purely local is limited as to time. The remedy acts only as long as it remains in contact with the tissue, and, as I have unfortunately experienced, does not surely

prevent recurrences. I say unfortunately, because we at first indulged in the hope that by the iodoform treatment every fungous process would be ended once and for all. I must also not conceal from you the fact that there are many cases of severe caries which resist the iodoform treatment entirely. Improvement indeed shows itself at first, clean granulations develop, and the discharge lessens, but absolute healing does not take place. I emphasize this in order that you may not allow yourselves to be misled by your faith in iodoform into treating a joint entirely disorganized by caries, conservatively, instead of amputating at once. Even the iodoform treatment has its limits.

In conclusion, gentlemen, I should like to describe a twofold method of applying iodoform, first introduced by me, which does not relate to its use as a dressing, but more to its anti-tuberculous action. My purpose was, mainly, to make use of the

specific action of iodoform in inflammatory tuberculous processes which had not yet led to external opening. The results of my efforts have thus far been so favorable that I can give you my method in brief and recommend it to you.

I first had in mind the early stages of fungous joint inflammations, which manifest themselves through diffuse or circumscribed spongy infiltration, and are followed later by serious and lasting disturbance of function. Should it succeed to inject iodoform in a suitable manner into such infiltrations, it ought to be possible to thus bring the process to an early termination, or at least prevent its further progress. I, therefore, made parenchymatous injections of iodoform and used the etherial solution, (1-5) of which, half a hypodermic syringe-ful was injected twice a week into the fungous masses and the joint itself. The injection produced a brief, sharp pain, and was as a rule, accompanied at first by slight local reaction, in-

creased swelling and tenderness. After the fourth injection, I noticed in three cases rapid diminution of the tumor and decreased tenderness. In four or five weeks the joints were much less swollen, but little tender, had slight motion, and as far as my observations reached, remained so afterwards.

Let me here say that, according to my view, this sort of treatment is only suited to fresh cases of tumor albus where the fungous masses are still solid and sufficiently vascular to admit of absorption of the disintegrated or liquified tissue elements. When the fungous masses have already begun to soften, or even abscesses are present I believe the parenchymatous injections to be no longer suitable. At least, in three such cases where I made the experiment, I observed that the process as such was not influenced, but on the contrary, accelerated. In such cases it is surely more judicious to at once decide upon opening, scraping out, and the open iodoform treatment.

My second experiment was made in the

treatment of cold abscesses with iodoform, and I had above all to deal with the typical, and unfortunately, not rare abscess of the thigh, connected with suppuration in the pelvis. Although the abscesses become very burdensome by their often immense size, it is on good grounds that we reluctantly decide to open them. With the abscess the patient can get about after a fashion, but with the antiseptic dressing after opening, not at all.

In the first case of this kind, I proceeded as follows: I punctured and emptied as thoroughly as possible, with Dieulafoy's aspirator, an abscess larger than a child's head, situated on the inner side of the thigh, beneath the genito-crural fold, and injected one hundred gm. of the earlier mentioned suspension of iodoform in glycerine and oil, (Iodorf. 10., Glyc. 80., Oil olive, 40.) Over this was applied a firm compression bandage of adhesive plaster. The patient who was treated as an ambulant, felt from the

time of puncture much relieved, and was able at once to go on with his work. The adhesive bandage was thrice renewed, and after four weeks the patient wore only a simple bandage. The abscess cavity did not entirely disappear, but remained reduced to about the size of an apple, and remained so as long as the case was under observation (seven weeks).

The second case, a similar one, presented an abscess almost twice as large, which a former nurse from Billroth's clinic had carried on her thigh for nine months. The proceeding was here gone through with three times, at intervals of about four weeks. The abscess grew considerably smaller after each puncture and iodoform injection, and since the last one, the original cavity, twice as large as a child's head, has been reduced to the size of the first, and has not increased during five months. The patient, who up to that time was unable to work, now performs light duties about the clinic.

During the treatment I noticed that after each injection the patient had nausea, which however, disappeared after an hour.

In two other cases, this method of treatment, as far as I am able to judge in the short period for observation, seems to establish itself. I chose the fluid form of iodoform for injection in these cases, as I think we are best able in this way, with the help of compression to obtain the greatest action of the remedy upon the abscess membrane, and where possible, upon the original seat of the disease. On this account I wish to lay great stress upon the after coming compression, which should force the iodoform against the abscess walls and thereby produce a more powerful action. I purposely took glycerine and oil as constituents of the suspension. The first becomes more quickly absorbed, so that later only oil and iodoform remain, of which I was able to convince myself in the second case, when I made the later punctures. As iodoform is quite readily

soluble in oil, and the latter only with difficulty taken up by the abscess membrane, an even and prolonged action of iodoform upon the abscess walls is assured.

Thus I am at the end of my remarks.

I have tried, gentlemen, to give you a view of the present state of our knowledge in regard to iodoform, and endeavored to indicate in what manner you may be able to apply this excellent remedy in the different cases of your private practice.

With the rapid advances in surgery, to which we are accustomed at present, the iodoform treatment may in the shortest time experience further development, and much that we at present consider as valuable, perhaps give place to something better. We are already indebted to iodoform for a progress so important, that we must look upon its introduction into surgery as a far-reaching reform through which, it above all else becomes possible for the antiseptic wound treatment to be the common property of all.

**BEACH'S PRINCIPLE
OF
BULLET WOUND TREATMENT.**

BEACH'S PRINCIPLE.

It is a great pleasure for me to be able to claim for Dr. Beach the establishment of the principle of bullet-wound treatment, the value of which I shall endeavor to prove in the following remarks and quotation of cases.

It is also gratifying, in this connection, to see that surgeons are pretty generally agreed upon the course to pursue in the treatment of bullet wounds of the abdomen and chest. In other instances, however, they appear, as a rule, to disregard the following principle of bullet-wound treatment: "Never disturb a bullet wound unless there are positive indications of the

necessity of so doing. A bullet entering the body in the usual manner is as harmless as a tooth filling and soon becomes encysted."

There is, perhaps, no better and briefer way of proving the soundness of this theory than by considering the cases contained in the following pages. If we go back to the time of Guthrie, or no later than the war of the rebellion, for instance, we can imagine if not estimate the great difference that thorough antisepsis would have made in the results. To the surgeon of to-day, judging from a standpoint so vastly different from that of but a few years ago, it seems to me that the collected cases must read with all the interest of a romance. The mere performance of laparotomy is no great feat for him, and therefore nothing of which he thinks with any particular apprehension, but he fully realizes that the best surgery teaches how to avoid an operation when that is possible

and advisable. In connection with bullet wounds of the abdomen the following summary from a leading article in the *Medical Analectic* for February, 1888, appeals to one's reason :

"The present views of the majority of surgeons in regard to bullet wounds of the abdomen, gathered from the literature of the past few months, seem to be as follows :

"First. A person having received a penetrating bullet wound of the abdomen, with probable wounding of a viscus, may recover without operation.

"Second. The wound in the abdominal wall should not be explored, unless one is prepared to perform laparotomy, if the wound proves to be a penetrating one.

"Third. Long-continued shock is a contra-indication. Peritonitis is not a contra-indication, but it renders the operation much more difficult.

"Fourth. If laparotomy is performed the

incision should be a free one in the linea alba.

"As the shock of the operation is due largely to the exposure of the intestines to the air, care should be taken to have as small an amount as possible out of the abdominal cavity at any one time.

"The more practice the operator has had with intra-abdominal manipulations, and the more efficient assistance at hand, the better are the chances of a successful result."

If inquiry went to show that the bowels were probably empty, or not filled with fluid contents at the time of wounding, there would be no reason to expect danger from escape of fecal matter. Where, however, there was reasonable evidence that this accident, or hemorrhage, had occurred, there should not be a moment's hesitation to avoid their possible effects by immediate operation.

A bullet wound differs in nature from

any other in that its character is very much determined by the rapidity with which it is produced. For instance, in the celebrated Warren Museum crowbar case, an injury resulted which, if imitated by any slower process of pushing the crowbar through, would without doubt be fatal. Again, the difference between pulling a cloth from beneath objects placed on a table with a rapid twitch or by a slow movement. In the one case the objects are left on the table ; in the other they are pulled off with the cloth. Or between dropping and drawing a pin through a soap bubble. All this of inertia and other laws of physics is familiar to us, and may have its application here. Certain it is that bullets have been known to pass through tissues where no trace of cicatrix has been found at the autopsy. How many veterans of the Grand Army are not only carrying bullets about with them, but in them, to-day? What quieter resting-place has a musket

ball ever been found in than when it has been discovered on sawing through an elephant's tusk? Naturally, when a ball has carried in with it more septic material than the economy can take care of, it begins to create trouble and proves an exception to the rule. But more often the trouble comes because some bullet, harmlessly lodged in a bed of soft parts or bone, has been fruitlessly and septicallly, to a greater or lesser degree, searched for with probe or other instrument.

This same principle can be no more clearly stated than in the following eight propositions taken from a very able paper on the "Early Treatment of Gunshot Wounds," by Roswell Park, A. M., M. D., Professor of Surgery Medical Department University of Buffalo, published in the *Physician's Magazine* for August, 1885.

"1. The injury which a bullet may inflict is done by it as it passes in its course ; in other words, instantly ; any subsequent

harm usually comes from unwarranted interference.

"2. It is so heated in its passage out of the weapon and through the air that it kills any germs which may have found lodgment on it; *i. e.*, it enters the body in an antiseptic condition.

"3. Even when its wound of entrance and the direction of its path from outside the body are known, it is absolutely impossible to predict where it may be found within the body.

"4. A leaden bullet imbedded in the tissues is, *per se*, an innocuous and inoffensive substance; that this is true is proven by innumerable experiences of military and civil surgeons.

"5. Unless other and poisonous material has been carried into the tissues, nothing has entered which, except from æsthetic motives, needs to be removed or is likely to do harm.

"6. Supposing that shreds of clothing or

impurities of any kind have entered ; they are seldom to be discovered, much less removed, by mere probing.

"7. By the act of probing, Nature's occlusive blood clot is broken up, and the entrance of air permitted ; a dirty probe not rarely made to serve as a carrier of infection ; and last, but not least, it is ten to one that no real information is gained as to the position of the bullet. Hemorrhage which had spontaneously ceased is often provoked afresh, and may not be easy to check a second time.

"8. General observation of the patient's condition will show whether a vital part has been injured or not ; pulse, respiration, amount of shock, hemorrhage, peritonitis, pleuritis, coma, hemiplegia, as well as various other objective features, will give vastly more reliable information and of greater extent than can possibly be obtained by the probe."

I will not add further argument of my

own, but will submit the following cases, preceding them with those taken from among Dr. Beach's, as furnishing the most typical and valuable evidence. I would lay stress upon the fact that there is no attempt to make of a principle an invariable rule, but to establish the principle. That this has elsewhere not been done, in this country at least, the daily accumulating newspaper evidence that "the doctors probed for the ball" will readily testify.

DR. BEACH'S CASES, WITH THE EX-
CEPTION OF CASE I., TAKEN
FROM THE RECORDS OF THE
MASSACHUSETTS GENERAL HOS-
PITAL.

Case 1. Reported in the *Boston Medical and Surgical Journal*, 1876, vol. xciv., p. 238. Case seen in consultation with Dr. Bemis of Medford. Patient, a man of twenty-seven years, attempted suicide with pistol fired over heart. "An examination of the injured region disclosed a small wound between the fifth and sixth ribs of the left side, in a vertical line, and two and a half inches below the nipple of that side. The skin for two inches around was blackened by powder." "If the location of the ball had warranted explorations, his weak condition forbade it." There were symptoms of spine injury, paralysis of motion and sen-

sation in the left leg, but the patient, contrary to the expectations of consultant and attending physician, ultimately recovered.

July 30, 1879, G. E. F. B., a policeman, while on duty was shot in the eye. The ball penetrated the globe and sight was destroyed. The eye was enucleated, and it was then found by careful probing that the missile had penetrated further backwards and downwards. No attempts at its removal were made and the patient was discharged well at the end of two weeks.

Aug. 21, 1881, F. K., twenty-one years of age, single, an artist, attempted to end his life by shooting himself. The ball, a twenty-two calibre, entered (on the right side) between the cartilages of the sixth and seventh ribs, about three and one half inches from the median line. There was no discharge from the wound. It was undisturbed, and the body surrounded with an antiseptic dressing of phenyle gauze. During the first four days there was severe pain in

the neck and shoulder on the wounded side, and also some abdominal tenderness and tympanites, but this was controlled with morphia, and the patient made a good recovery, and was sent home at the end of twenty-two days.

Aug. 11, 1881, M. L., female, æt. 23 years, married, was accidentally shot in the back with a twenty-two calibre revolver. The ball entered about four inches above the posterior superior iliac spine, two inches to the right of the median line, and penetrated deeply. No attempts at removal were made and the parts were surrounded with a phenyle gauze dressing. Recovery was complete in twelve days, although there was much pain in the hip and thigh for the first forty-eight hours and *two bloody dejections* on the sixth day.

Oct. 3, 1881, W. F. D., a glass worker, æt. 41 years, came to the hospital, having been wounded three days before with a twenty-two calibre revolver. The wound

was scabbed over and extended, as evidenced by tenderness and induration on careful palpation, inwards beneath the pectoral muscles towards the sternum. The parts were kept quiet in bed, and the wound left, as upon his entrance, covered with adhesive plaster. Owing to a slight discharge on the second day the parts were thoroughly enveloped in phenyle gauze. There was considerable tenderness and induration, but the patient was discharged without further treatment in nineteen days.

Oct. 14, 1881, S. W., boy, fifteen years of age, accidentally shot himself in the hand with a twenty-two calibre pistol. The ball entered the palm between the pisiform and trapezoid bones. Had been probed for but not found before entering the hospital. The wound was thoroughly antiseptized and was done up in phenyle gauze. Recovery was complete and there were no signs of disturbance at the end of nineteen days.

Oct. 17, 1881. Chas. O'C., also accidentally shot himself in the palm of the hand with a twenty-two calibre pistol. The ball entered midway between the bases of the first and third metacarpals. The hand was done up in phenyle gauze without disturbing the wound and the patient made a good recovery. Eighteen days after accident there were no signs of disturbance.

Oct. 25, 1882. M. B., a lad of 12 years, accidentally shot himself in the chest with a twenty-two calibre revolver. The ball entered on the right side between the third and fourth ribs about one inch from the sternum. Hemoptysis followed, but had ceased when the patient was brought to the hospital one hour later. The wound was not examined, and the parts after thorough phenylation were enveloped in phenyle gauze. There were no bad symptoms later on and recovery was perfect, patient being convalescent in sixteen days.

OTHER CASES
TAKEN FROM LITERATURE.

1. The first part of the document is a list of names and titles, followed by a list of dates and times.

OTHER CASES.

CASES TAKEN MOSTLY FROM RECENT LITERATURE ON THIS SUBJECT AS BEING OF SPECIAL VALUE FOR THE PRESENT PURPOSE. THE ACCOUNTS ARE MOSTLY DIRECT QUOTATIONS. THE ITALICS ARE MINE.

CASE I.

(From "Guthrie's Treatise on Gunshot Wounds,"
published in 1827.)

"A soldier of the ninety-second regiment, forty years of age, was wounded by two musket-balls in the right hand and wrist, on the 25th of June. On the 5th of July, the arm was swollen above the elbow, the hand œdematous, the discharge profuse and fetid, countenance sallow and dejected, the skin hot, bowels confined, tongue loaded, pulse ninety. 6th. The

bowels opened by medicine, tongue cleaner, skin cool, pulse eighty, wound discharges profusely, patient much debilitated. 8th. The arm amputated above the elbow. (The whole forearm lost in consequence of the operation having been delayed, and the extent of the swelling and inflammation which ensued). 9th, 10th, and 11th. A little increase of fever, the bowels being kept open, and saline medicines administered. 12th. Had a paroxysm of intermittent fever, which he has been subject to since the expedition to Walcheren. On removing the dressing, the edges of the stump were retorted, the discharge copious and fetid, respiration hurried, complains of thirst, skin hot, pulse ninety, skin tinged of a yellowish color. 14th. Had a return of the paroxysm this morning, respiration still hurried, pulse ninety, bowels open, head affected in consequence of the long continuance of the hot fit. Stump very irritable, and discharging profusely.

Calomel and antimonial powder were given every three hours ; saline draughts ; the bowels kept open. 15th. Complains to-day of fulness and pain in the left side, pulse one hundred, skin tinged of a deeper color, a sense of suffocation in the horizontal position. A blister was applied to the whole of the left side. 16th. The blister rose well, but did not relieve the pain in the side. Was delirious during the night, vomited frequently, and about the usual period of the attack of the intermittent he became insensible, and died in the evening.

Dissection. On opening the chest, the lungs were found to adhere to the pleura costalis in several places, had lost their usual spongy texture, and were dense like liver ; a quantity of serum and coagulable lymph was contained in the left side, sufficient to prevent the dilatation of the lung, in which a small abscess had also formed. The viscera of the abdomen were sound,

with the exception of the liver, which was enlarged to twice its usual size.

Dr. Hennen, page 272 of his valuable work on Military Surgery, has related the particulars of a case, which was communicated to him by staff-surgeon Hughes, of an abscess of the liver taking place nine days after secondary amputation of the thigh, and destroying the patient on the fourth day from the appearance of the attack."

CASE II.

(From "Surgical Observations," by J. Mason Warren, 1867.)

"Case 336. Wound of chest from pistol balls. Death eight years after. Pistol balls suspended within the chest by the pleura. In a fit of jealousy, a man shot his mistress, coming behind her while she was sitting on a low bench, and firing down upon the chest. He then placed a pistol to his heart and pulled the trigger. In the act of discharging the pistol the muzzle

became elevated, so that the bullets just escaped the heart and great vessels in their passage through the chest. Both these patients came under my care at the time.

The woman lived three days and then died in great agony. On a post-mortem examination it was found that one of the bullets had passed through the cavity of the chest, and lodged in the body of a dorsal vertebra. This vertebra I now have with the ball deeply imbedded in it. A second bullet struck the first rib, *was cut in two by it*; one half traversing the top of the rib, the other traversing the lung, being found loose in the cavity of the chest. The hemorrhage produced by this wound filled the chest, compressed the lung, and was the immediate cause of her death. The third bullet entered the neck, and its course could not be traced.

The man, immediately on being wounded, had great emphysema of the walls of the

chest, followed by entire flatness on percussion of that side. After a very severe illness, he recovered sufficiently to be brought to trial ; and, being convicted, was sentenced to the State prison for life.

I saw him at the prison about four years after. He then had a constant, dry cough. On auscultation, the respiration was found rough on the left side, and somewhat bronchial. There was no râle. Percussion revealed nothing abnormal. His health was otherwise good.

He died suddenly eight years after the crime was committed. On examination, it was supposed by Dr. Morris, surgeon to the prison, that some disease of the heart would be found to explain his death. No sufficient disease, however, could be detected. The valves of the heart were thickened, but not enough to impede their action. In the upper lobe of the left lung a cicatrix, showing the course of the balls, was distinctly visible. The balls, having tra-

versed the lungs had lodged in the side of the chest. From this place they had become gradually detached, and *were found suspended from the sides of the chest, like cherries hanging from a tree*, having carried the pleura before them and being enveloped in that membrane."

CASE III.

(From the *Brit. Med. Journal*, 1880, p. 735.
Walter Buchanan, M.R.C.S.E., etc.)

"I was called to J. E., who had attempted to commit suicide, by firing a revolver into his mouth. On examining him I found a very little blood on the mouth. On washing it out, I found the right side of the tongue charred, and an opening through the right tonsil about the size of a goose quill. On exploring this my director took an upward and backward course, to the transverse process of the first cervical vertebra and then towards the left. I could detect the bullet firmly impacted in the body of

that bone. The man seemed none the worse for the injury. I held a consultation, and we decided that it would be injurious to attempt to remove the bullet. He was committed to prison and thus I lost sight of him for ten weeks. He is now in perfect health and in no way suffers from the bullet, which has never been removed.

CASE IV.

(From the *Brit. Med. Journal*, 1880, p. 53.
Herbert L. Bernay, M.R.C.S.)

“At the post-mortem examination, the bullet was found in the liver, but not at the spot where it pierced the skin. It had glided over the smooth surface of the liver to the right side; there it appeared to have struck a rib, rebounded, and entered the liver to the depths of about three-quarters of an inch. There were about three ounces of old blood clot, probably effused at the time of injury, and a fair amount of partially organized lymph around the

wound. The small cavity where the ball lay was lined with very well organized lymph. Nowhere was there any sign of abscess. The functions of the liver were well performed to the last. All the other organs were healthy. The child certainly did not die from the presence of the ball in the liver but simply from exhaustion from not taking sufficient nourishment.

CASE V.

(From the *New Orleans Med. and Surg. Journal*, 1880, p. 1031. Read before Attakapas Medical Association, March 4, 1880.)

Paul F. was accidentally shot in the shoulder with a 32-calibre Smith & Wesson revolver. The ball had entered the shoulder at the anterior edge of the deltoid muscle ; there was very little hemorrhage. *A No. 8 female catheter used as a probe* passed readily into the wound and struck denuded bone, evident from roughness and peculiar feel on probing. Crepitus was distinctly felt, and examination showed fracture of surgi-

cal neck. The ball was not found and it was concluded to dress the wound with the best obtainable Lister dressing gauze, wet with 1-50 carbolic acid solution, and postpone the projected resection of the head of the bone until the morning. "Together we visited our patient the next morning with instruments, etc., all ready, but much to our surprise our patient presented little or no local or constitutional disturbance; was cheerful and bright."

The shoulder was eventually done up in a fenestrated plaster-of-Paris bandage and recovery was complete "with no deformity."

CASE VI.

In the *British Medical Journal* for Oct. 18, 1884, Mr. Herbert Parsons reports the case of a Uruguay girl, thirteen years of age, who received a revolver wound of the brain. "The ball passed through the mastoid process of the temporal bone and took a course inwards through the convolutions of the brain,

with a slight downward direction. She fell down unconscious, but recovered complete consciousness one hour later. The wound was examined with a bullet probe, and then the orifice filled with iodoform. There was never any fever or nervous disturbance beyond hemiplegia. She became perfectly well and had remained so eighteen months later. The ball was of very small calibre."

CASE VII.

In the *New York Medical Journal* of June 10, 1885, Chas. A. Powers, M. D., writes an interesting article from which the following is quoted: "At this hospital, the local treatment of pistol wounds is essentially the same in all cases, but slight attempts at probing are made; no endeavors are made to hermetically seal the aperture; a slight, but thorough antiseptic dressing is applied, which in many instances is left on until the wound is entirely closed."

CASE VIII.

C. L., thirty-eight years of age, a German silversmith, was shot in the left chest with a 44-calibre revolver. "Examination revealed a punctate wound, four centimeters below the middle of the clavicle, *which admitted the end of the little finger.*" A probe gently introduced passed easily backwards, inwards, and somewhat downwards, and being arrested, was withdrawn and no further attempts were made with it." There was one attack of hæmoptysis, but no recurrence of it. Recovery was complete.

CASE IX.

Also, T. J. C., fifty-four years, married, a bank porter, was shot by a man ten feet away, firing upon him in full front. The ball, a forty four calibre, entered between the cartilages of the third and fourth ribs, two centimetres to the right of the sternum. "*The wound freely admitted the*

end of the little finger." The ball was not removed and recovery was complete in thirty-seven days. Later on, the ball which was at first to be felt in the infraspinous fossa of the scapula, was removed.

CASE X.

In the *London Medical Press and Circular* for Jan. 7th, 1885, Mr. W. F. Smart, F. R. S. C. I., reports the case of a coolie, admitted to the Demarara hospital, with a bullet wound over the sixth rib, one inch from the sternum. Bullet eighty grains weight, fired at a distance of three yards. Believing the ball to have penetrated the abdomen, S. operated after giving fifty drops of laudanum and one ounce of brandy. An exploratory incision, two and one half inches long, was made over the cartilage of the eighth rib, through the skin and subcutaneous cellular tissue. This was further carried down into the substance of the liver and the

ball removed. The operation was followed by a "state of utter collapse." After a most critical illness the patient recovered. The author says in conclusion: "I merely bring this case forward in the hope that it may elicit the opinions and experience of others on the utility of iodoform as an antiseptic."

CASE XI.

In the *British Medical Journal* for Feb. 21, 1885, Mr. T. Fred Gardner, M. R. C. S. E. and L. R. C. P., London, reports a case of accidental wound of the skull, occurring Aug. 13, 1884, with a smooth bore gun, firing a one and one-half ounce ball. The wound was over the left eyebrow, round and smooth, "*admitting the finger*, and bleeding freely. The brain was felt pulsating through it. Seven weeks later the patient was discharged, Dec. 12. The intellect was clear in every particular, and there was not the slightest trace of paralysis anywhere, nor of any symptoms of irritation of the brain."

CASE XII.

In the *Australian Medical Journal* for March 15, 1885, Mr. E. S. Jackson, M. B. Ch. B., reports the case of a boy, aged eight years, who was accidentally shot by a schoolmate in the left malar region. "On admission there was a small blackish scab over the wound, and some swelling around it. The patient was partially conscious, extremely restless, and occasionally wandering. Pupils dilated, no paralysis. The scab was poulticed off and revealed a sinus, extending through the malar prominence backwards, slightly inwards and upwards. At a consultation with the visiting surgeons a long probe was passed along the sinus right to the back of the brain, but no bullet was met with. The wound was then dressed with carbolic oil daily, and the patient kept in quiet and darkness, with occasional doses of bromide of potash and chloral and an ice bag to his head." Five

days after admission a note was made to the effect that he was much quicker and more conscious than when first admitted. He had been passing water without assistance. On the 19th day of July, twenty-four days after admission, his only symptom was a slight loss of memory, and he was able to sit up in bed a little each day. He was then allowed to get up, and from that time continued to improve as before, until his discharge on Aug. 23d, when he was in perfect health, but still had a sinus in the cheek, at the bottom of which, at a distance of about one and one half millimeters, some small pieces of bare bone were to be felt.

CASE XIII.

Also, J. H., æt. 29 years, a bullock driver, accidental revolver wound of right knee, which was in a flexed or semiflexed position. "On examination there was a slight swelling of the right knee on the inner side of the joint just over the promi-

nence of the internal condyle of the femur. There is a small bullet wound leading by a sinus about one half inch long straight into the osseous tissue and not communicating with the joint which was slightly distended with fluid. No bullet could be discovered with the probe, which was used with the least degree of violence. The patient was ordered to be kept in bed and the knee fomented.

On the first day of August, eleven days after the injury had been inflicted, he had done so well that he was allowed to get up. He limped slightly and complained of stiffness in the knee.

A week after last date, Aug. 8, he was discharged, at his own urgent request, with the wound healed, and was able to walk with little or no limp. There was still, however, slight impairment of the power to flex the limb."

CASE XIV.

Also, M. P. H., æt. 28 years, cook, married. September 5, 1884, attempted to shoot his wife, and then to commit suicide by shooting, and finally by cutting his throat with a razor. There was a small wound above the right frontal eminence. On probing this bone could be felt, and between the skull and scalp, an inch and a half back to the right side, a lead mark was obtained with the Nelaton probe. "There is bleeding from the right ear and within it a blackened pistol wound, through which a probe can be passed slightly downwards and inwards into the throat, where the probe point can be distinctly felt through the soft tissues by the finger introduced by the mouth. On pressing the right tonsil the probe can be moved slightly out of the ear. His throat being also wounded, exploration was not persevered in, as it seemed likely to set up bleeding from the patient's

attempts to vomit. The throat wound, which has been made with a sharp instrument, is about three one-half inches long, extending transversely above the thyroid cartilage and at its central part into the pharynx, the posterior wall of which can be distinctly seen through the wound. Liquids pass through the wound upon arrival in the pharynx. He is, however, still able to swallow liquids when the wound is closed and the head slightly flexed. His consciousness is complete. A consultation was held, at which it was considered inadvisable to explore further for the bullets, till more urgent symptoms developed. The wound in the throat was thought to add to the danger of the patient's being anæsthetized. Treatment consisted in syringing the ear daily as necessary with a disinfectant solution. Throat wound brought into opposition by flexing the head; no sutures were used; dressed with a clean towel, changed as often as necessary.

"September 21. A note is made, that beyond slight earache he has not had a bad symptom and can hear a watch ticking with his right ear. Wound of throat closing fast.

"November 10. He was handed over to the police and entered in the ward-book discharged, improved.

"The medical officer of the penal establishment in which he is now undergoing a life sentence, informs me that the throat wound is quite healed, also that in the forehead. There is still some discharge from the ear."

CASE XV.

In the *British Medical Journal* for April 4th, 1885. Mr. Richard Barwell reports three interesting cases of gunshot wound, among them: Case 3d. Carl F. shot himself in the mouth and in the ear with a revolver just a quarter inch bore, Oct. 24th, 1884. The wound first named was on the left side of the soft palate, and the

ball penetrating that part, inflicted another wound in the posterior wall of the pharynx. The bullet had never been found, and had given no trouble. It was probably encapsuled among the deep muscles on the left of the spine. The other bullet passed for three-quarters of an inch through the auditory meatus without injuring it on either side, then continuing its directly transverse course, it left that channel by a small wound at its posterior part. A probe passed in here touched a substance, which Mr. Barwell believed to be metallic, exactly two inches from the margin of the meatus. The depth and the direction of the wound caused abstention of any attempt at extraction, because it appeared to Mr. Barwell that the projectile must lie in a very dangerous proximity to the lateral sinus. After 48 hours, abundance of clear serum became mixed with the blood discharged; it was either cerebro-spinal fluid, or liquor contunii; the admixture of blood then of

pus prevented any testing for sugar. The man, who was singularly apathetic, progressed favorably, with the exception that a week after the infliction of the wound, the parts about the angle and ascending ramus of the jaw swelled and shortly after suppurated. On December 4th, there was sufficient disturbance in those parts to indicate that the *projectile* was producing considerable irritation and ought to be, if possible, removed. Moreover, if, as seemed possible, the lateral sinus had been injured the wound would in the five weeks have healed. With some difficulty, for it was rather large, Mr. B. passed a Nelaton's probe sufficiently far to obtain the lead-mark. Making a curved incision behind the pinna he trephined the mastoid process to the depth of three-quarters of an inch; finding a small track leading still deeper, he again got on the Nelaton's probe the lead-stain, but at a distance from the trephining hole of more than an inch. The

track was cautiously enlarged with a gouge and a pair of sinus forceps was passed down to the bullet, which, *although very firmly fixed in the bone, was successfully removed.* After this operation, the man had no bad symptoms, the abscess in the jaw was opened, the trephine hole rapidly filled, and by the middle of December he was well.

CASE XVI.

Another case was that of a gentleman who shot himself with a pistol less than a quarter inch bore. The wound was within the areola of the left nipple; but the weapon must have been held obliquely, for the bullet missing the heart by probably very little passed through about eight inches of the left lung, and lay outside the chest near the lower angle of the scapula. There was very considerable hemorrhage from the wound and coughing caused the blood to be driven out several feet. There was also a good deal of hemoptysis. Strict quietude,

ice, acetate of lead, and opium, subdued in about fifteen hours the external hemorrhage, but the hemoptysis continued for six days. Pneumo and hemothorax together with surgical emphysema, were very marked. Pneumonia came on, on the seventh day. After the lapse of three weeks, during which he had been in a very precarious condition, improvement set in which steadily and rapidly progressed. On the 35th day, Mr. Barwell removed the bullet, which he had hitherto avoided, wishing the wound of exit from the chest to become previously closed. Seven weeks after the injury the man was discharged from care, somewhat weak, but quite well.

CASE XVII.

In the *Transactions of the N. Y. State Medical Association* for 1884 is reported, on Nov. 10, by Dr. John H. Hintor, a case of pistol shot wound through the stomach followed by recovery. The patient was a

young man of twenty-one years. The ball entered over the tenth rib about five inches to the left of the spine, and could be felt under the skin in front, two inches from the median line, three inches from the umbilicus. Wound in the back was closed with adhesive plaster. "Within three hours after the shooting, I removed the ball from under the skin, and I ascertained by exploration with the point of the little finger, that the ball, a conical 32-calibre, had passed through the cartilage beneath. This fact, taken in connection with the vomiting of food and blood, showed that the ball had passed entirely through the stomach. Flax-seed poultices were applied over the anterior and posterior wounds, and he was ordered to have no food by the mouth, enemata of milk being given every four hours. During his illness, the patient vomited blood several times, and had numerous bloody dejections, but was discharged well at the end of forty-one days.

"That we might in some wise imitate such an injury, I directed my house officer to fill the stomach of a cadaver with water to about the quantity of an ordinary breakfast and then to shoot it from behind. The ball entered the body at about the same place as in the case related above, and by the dissection, it was shown that it passed through both walls of the stomach and lodged in the anterior abdominal muscles. The posterior wound of the stomach was guarded by a valvular flap of mucous membrane which prevented the escape of liquids. The anterior wound had no flap as might have been supposed, yet the wound was almost closed, which in all probability would be the case in living tissues."

CASE XVIII.

In the *Pacific Med. and Surg. Journal* for July, 1885, A. B. Stuart, M. D., of Santa Rosa, California, reports the following case.

"Joseph Elliot, aged about twenty-five

years, American born, of German extraction, farmer by occupation, while engaged in conversation with a friend at a railroad station waiting for the incoming train, was accidentally shot, the pistol, a 32-calibre, being in the hands of a physician deeply under the influence of liquor. How or why the pistol was discharged no one knows ; but that it was unintentional on the part of the doctor everyone present believed. The ball struck the left parietal bone about midway between the temporal and occipital bones, and three inches from the lower portion of the mastoid process of the same side, passing through the skull and taking a slightly upward course, in the direction of the centre of the upper border of the temporal bone on the opposite side. About an inch and a half from the external wound, I detected with a probe what I supposed to be the bullet, but when removed it proved to be only a thin ring-like portion, such as you would expect to see from forcing a leaden

ball through a hard metal tube rather too small to admit it. Believing that the greater portion of the bullet yet remained in the brain, I again introduced my probe, which passed easily and unobstructedly four inches from the external surface, where it met with a slight resistance, but not occasioned by the ball, or any other foreign substance, and fearing that I might do unjustifiable injury to the brain, I withdrew the probe and discontinued further manual examination. Having no drainage tube, a tent was substituted, passing it in just far enough to give vent to a slight bloody discharge then present, applied cotton, wet in carbolized water, externally, and recommended the attending surgeon to open the bowels with a saline cathartic and put the patient upon opium, bromide of potassium and aconite." * * "I am told that the tent was removed next day; external wound soon healed, and our man had a speedy getting up, but was never again his former

self, either in mind or body." * * "He is now dead, having died of typhoid fever about two years after the injury just reported." No autopsy!

CASE XIX.

In the *Transactions of the American Medical Association*, Drs. Edward and E. Wyllis Andrews report some interesting revolver wound cases, from which I quote the following :

"The first wound was made by a twenty-two calibre bullet, which entered on the linea alba, between the umbilicus and the xiphoid cartilage, traversing directly backwards. The stomach was empty, considerable shock ensued, but no vomiting. The patient was treated by opiates and starvation. On the tenth day he passed the bullet per anus. He recovered without signs of peritonitis."

"A second case had a thirty-eight calibre bullet shot completely through the body on

nearly the same line as the previous one. Laparotomy was proposed to him, but he refused it. His stomach had no food in it at the time of the injury, but he had taken considerable beer. As he rejected the operation he was placed upon starvation and opiates, and recovered without a single symptom."

"The third case, not ended at the time of reporting, was shot with a thirty-eight calibre ball, which went in through the border of the cartilages or the ribs upwards, and to the left of the umbilicus, and came out at a point behind about opposite. On his arrival there was a slight elevation of temperature, and pressure detected a diffuse tenderness of the abdomen extending down to the iliac region on the right side; the pain, however, was moderate, and the decubitus was not that of decided peritonitis, as he showed no desire to draw up the knees. Laparotomy was deemed advisable and performed; but no signs of

perforation were discovered. The incision which had been made antiseptically was closed, and the patient treated by starvation and opiates. On the sixth day the patient had recovered from signs of peritonitis, but was suffering from delirium tremens, due probably to his 'being daily accustomed to imbibe fifteen glasses of beer.'

"It is clear that the first two patients suffered nothing from the omission of laparotomy, and it is not clear that the third derived any benefit from it. True, there was removed some bloody serum, but blood which has not been exposed to the septic germs of the atmosphere by laparotomy is often absorbed without trouble."

CASE XX.

In the *New York Medical Record* of Aug. 22, 1885, Dr. Willis Butterfield of Belvidere, Ill., reports "an interesting case of a little girl, Gertie M., 10 years of age, who

was standing talking to a companion, and suddenly sunk down to the ground, apparently lifeless. Her playmates heard a queer noise, which was the spud of the bullet which struck the girl's head an inch above and behind the right ear. When Dr. B. saw her a few minutes later, she was wholly unconscious, and on the walk where she fell was a pool of blood, containing about a teaspoonful of brain substance. Within half an hour an ecchymotic swelling appeared above the eyeball in the outer part of the right orbit. Blood had flowed from the nose immediately after the injury was received. Dr. John Best of Arlington Heights was called in consultation. The opening in the skull was round and clean cut on the outside, but splinters of bone could be felt projecting from the inner table. *An elastic catheter about the size of the external wound was used for purposes of exploration, as being less likely to injure the sound tissue.*

This passed about two and one-half inches into the brain and pointed in the direction of the right orbit, but the ball could not be detected. On account of the swelling and discoloration about the eye, it was thought that the ball had fractured the orbital plate, though no foreign body could be felt in the orbit. The wound was carefully dressed antiseptically, all spiculæ of bone projecting from the inner edge of the cranial wound being removed. The probing and removal of bone fragments caused no pain, but the patient moaned whenever the scalp wound was touched. Two or three hours later the child spoke a few rational words and the mental faculties were gradually restored. The temperature did not at any time rise above one hundred and one degrees. There was no paralysis and slight headache was complained of during the first few days only. In three weeks the child was out doors at play. The right eye remained more prominent

than the other, and at times there was double vision. After having made a number of examinations without result, Dr. B. at length discovered the ball in the right orbit between the inner wall and the globe of the eye. The patient being anæsthetized an incision was made in the conjunctive, and a thirty-two calibre ball extracted. The eyesight soon became normal and the little girl attended school the following autumn with all her mental faculties unimpaired."

Gunshot Wounds of Knee.—Sir William MacCormac comments as follows upon two successful cases, published in detail in the *Lancet*, Feb. 27, 1886, p. 389. The two cases recorded are striking from the similarity of the injury in each.

"The bullets causing the damage were almost alike in size, although one was discharged from a rifle and the other at close quarters from a pistol. The ball traversed the expanded portion of the condyles transversely, in both cases from within out-

wards, in each instance very near to the articular surface, lodging in the bone in both, and in both remaining undiscovered for a considerable time. In both, too, there were symptoms of inflammation in the knee-joint, some pain, fever, swelling, and subsequent stiffness, which passed off. It is difficult to believe that in either the injury could have been wholly extra-articular. Conical bullets such as these, and capable of penetrating the bone to so considerable a depth, would be very likely to cause fissures which would almost certainly extend to the joint surface, while the continued presence of the foreign body could scarcely fail, one would suppose, to excite articular mischief. Nevertheless, in neither of these two cases has any permanent ill-result followed, and the function of the joint is in both perfectly restored. There is a strong presumption, without, I admit, any positive proof, that the knee-joint was implicated to a greater or less degree in

each of these cases, yet recovery has ensued with a freely movable articulation, and certainly without, in either case, any special advantage in regard to treatment. Perhaps, after all, a gunshot injury of the knee may not be always so disastrous as it was at one time assumed to be. Langenbeck told me that he had met with at least one hundred cases of penetrating wound of the knee-joint followed by recovery during the Franco-German war. Many cases of recovery after a bullet had traversed the joint and fractured the bones are recorded by the Surgeon-General of the United States army; and then there are remarkable results published by Bergmann and Reyher obtained after antiseptic occlusion in the Russo-Turkish and other campaigns. During the American war, 338 cases of unmistakable fracture involving the bones of the knee-joint made good recoveries after an altogether expectant plan of treatment—that is, both life and limb were preserved. Many

of the cases, beside the one which I have first quoted, are most remarkable, but for the details I must refer to the Surgeon-General's report. A conservative treatment, whenever it is possible to adopt it, is probably by far the most promising one for gunshot injury of the knee-joint, and it has proved the most successful, especially in recent campaigns. Excision of the knee for gunshot injury in time of war has hitherto been disastrous, while amputation has been very fatal also."

In the *Gazette Hebdomadaire de Medicine et de Chirurgie* for Sept. 11, 1885, Paul Reclus, in an article entitled "Traitement des blessures par balle de revolver," ably argues in favor of this treatment and quotes the following five cases from his practice.

1. A boy of fifteen years received an accidental revolver wound with a ball of

9 m. m. calibre, which entered the right hypochondrium, pierced the liver, and lodged, as indicated by symptoms, at the base of the thigh in the depths of the proas muscle. The case when seen had already been probed to the depth of 10. cm. But, says the writer, " nous mettons fin a cette exploration dangéreuse." The wound was dressed antiseptically. The patient made a perfect recovery without further symptoms.

R. then states that all surgeons, however, seriously abstain from exploring wounds of the cranial, thoracic, and abdominal cavities, but doubts if the conduct of several of his colleagues would have been similar to his in the four remaining cases.

2. A major of artillery, while fooling with a small pocket revolver, shot himself in the left index finger, close to the metacarpophalangeal joint. The ball, a very small one, lodged in the bone. It was left in the wound, as the patient's wife ob-

jected to its removal on the grounds that she "*ne voulait pas d'un mari infirmé.*" Three months later the patient was seen, and had been without symptoms, and excepting a linear cicatrix there was nothing to indicate a former injury.

3. A girl, shot by her rejected lover with a revolver of small calibre, received a wound in the left breast. The ball penetrated beneath the muscles along the chest wall and appeared under the edge of the pectoralis major. A direct incision, a few centimeters in depth, would have sufficed to extract it, but it was let alone, and under an antiseptic dressing recovery was complete. The ball became thoroughly encysted.

4. A law student, shot by his mistress who supposed herself deserted, was wounded in the posterior cervical region. The ball penetrated the muscles and lodged against the occiput, as far as could be determined by superficial examination, palpation without stilet or sound.

The patient insisted on its extraction but R. absolutely opposed this. The wound was covered with iodoform and the parts immobilized with a stiff bandage. In several days cicatrization was complete, and at time of reporting case the most extended movements could be made without trouble.

5. Was an accidental wound of the thigh. The ball pierced the internal saphenous vein at the upper part of the limb and buried itself in the popliteal space. After being assured that the large vessels and nerves were intact, and as hemorrhage had ceased, the wound was dressed with iodoform and immobilized. The cutaneous orifice was a little long in healing, but on the twelfth day the patient was about his work.

CASE XXI.

“The patient died of septic infection of the blood. It was blood-poisoning, whether called pyæmia or septicæmia.

"The source of this infection is the subject of inquiry.

"The ball entered the body on the right side, at a point three inches and a half from the spinous process of the first lumbar vertebra. It fractured the eleventh rib, was then deflected downward, fracturing the twelfth rib, and passed across the axis of the body through the spinal column, in front of the spinal cord. It fractured the body of the first lumbar vertebra, and drove a number of small fragments into the adjacent soft parts. And it lodged about two inches and a half to the left of the spine, below the pancreas and behind the peritoneum, where it was found completely encysted.'

"The post-mortem showed that the ball was, and had been for a long time, completely encysted. It was, therefore, harmless, and must be eliminated from the list of agencies supposed to have produced the septic condition of the blood."

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